

AUTOMOTIVE INDUSTRIES

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HERBERT HOSKING, Editor JEROME H. FARRIS, Ass't Editor
 P. M. HELDT, Engineering Editor T. LAWTON SLAUGH, News Editor
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Contents

News of the Industry	641
Show Postscripts	647
Calendar of Coming Events	650
Comparative Prices of 1936 Models	651
The Horizons of Business	652
Interstate Oil Compacts Are Championed, New Fuels and Oils Presented to A.P.I.	654
Automotive Abstracts	659
New Seam Welder Produces Thirty Feet of Fuel Feed Tubing Per Minute—Made by Thomson-Gibbs	660
Test Cross Rotary Valve Engine	661
Factors Influencing the Durability of Spiral-Bevel Gears for Automobiles. By J. O. Almen	662
Just Among Ourselves	669
New Developments	670
Production Lines	672
Advertisers' Index	47

C. A. MUSSelman, Pres. and Gen. Mgr.; J. S. HILDRETH, Vice-Pres. and Manager; W. I. RALPH, Vice-Pres.; G. C. BUZZY, Vice-Pres.

OFFICES

Philadelphia—Chestnut & 56th Sts., Phone Sherwood 1424
 New York—239 W. 39th St., Phone Pennsylvania 6-1100. Chicago—Room 1116 London Guarantees & Accident Bldg., Phone Franklin 9494—Detroit—1015 St. Clair Bldg., Phone Madison 2090. Cleveland—309 Guardian Bldg., Phone Main 6860. San Francisco—444 Market St., Room 305, Phone Garfield 6788. Long Beach, Cal.—1995 Pacific Ave., Phone Long Beach 613-238.

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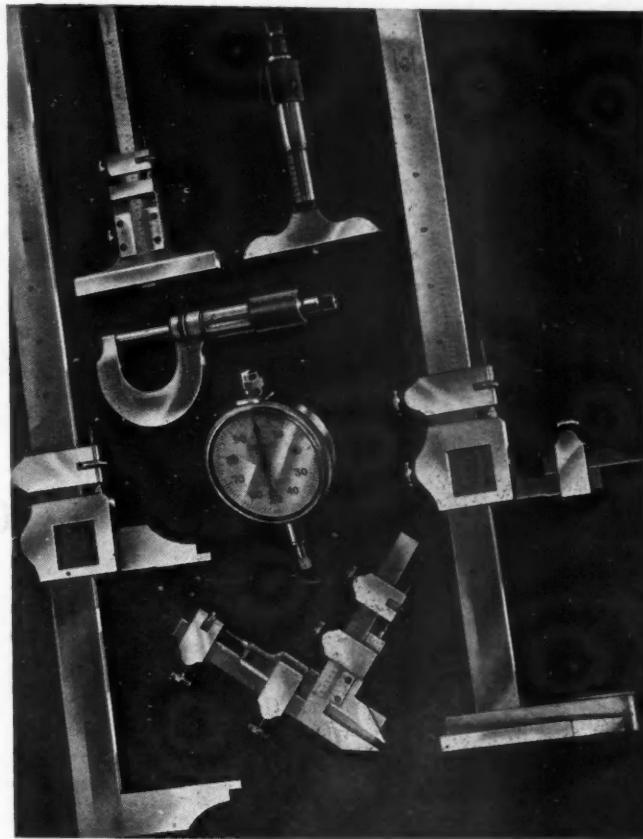
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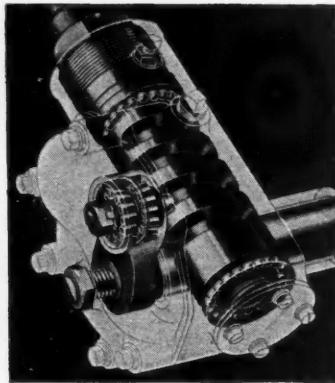
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November 16, 1935

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High-Speed Stability



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AUTOMOTIVE INDUSTRIES

Vol. 73, No. 20

□ THIRTY-SEVENTH YEAR □

November 16, 1935

Estimate 984,000 Units in Last Quarter

Chicago Show Calendar

Saturday, Nov. 16—Oldsmobile dealers' breakfast, Palmer House.

Monday, Nov. 18—NADA annual convention, Congress Hotel. Chicago Section, SAE, dinner, Stock Yards Inn.

Tuesday, Nov. 19—Auburn dealers' luncheon, Stevens Hotel. Graham-Paige dealers' luncheon, Stevens Hotel. Nash-LaFayette dealers' luncheon, Congress Hotel.

Wednesday, Nov. 20—Willys-Overland dealers' luncheon, Stevens Hotel. International Trucks dealers' luncheon, Congress Hotel.

Sales Gains Offset Slack Attendance at Local Shows

Gains in sales generally offset decreases in attendance at automobile shows throughout the country during the past and previous weeks.

Incomplete tabulations (as we go to press) indicate that New York's show attendance was approximately 20 per cent below that of last January; Washington's off 50 per cent; San Francisco, 25 per cent; Los Angeles, 15 per cent; Philadelphia, 27 per cent; Brooklyn, 12 per cent; Buffalo, 10 per cent.

Warm weather and outdoor attractions were held chiefly responsible for slack attendance.

Swift Rebound in Car Production Presages 4-Million Year in 1935

BY HAROLD E. GRONSETH

Detroit News Editor, Automotive Industries

So swift has been the rebound in motor production from the year's low point in September that all estimates for the final quarter and the full year unquestionably will prove too low. Only six weeks ago authorities were predicting that the 1935 output would be around 3,700,000 cars and trucks. No one then foresaw how quickly the factories would be able to speed into their new manufacturing programs. Progress, however, was so rapid in October that many plants overshot their original schedules and the month brought the sharpest recovery from a year's low in more than a decade if not in all time.

It now appears that the final figures on 1935 motor vehicle output for the United States and Canada will crowd the 4,000,000 mark and possibly surpass it.

The AMA report showing October production by members of 210,392 units means that the industry turned out 284,000 cars and trucks last month, almost trebling the September output and representing the biggest October volume since 1929. The best previous recovery was in December last year when production jumped 130 per cent from the November low point.

The quick resumption of heavy vol-

ume this year reflects not only a better state of preparation by the manufacturers, but also the urgent need for replenishing depleted field stocks as well as absence of labor and other manufacturing difficulties.

The industry is working on Novem-
(Turn to page 648, please)

U.S.-Canadian Pact Believed Motor Aid

Understood Substantial Reductions of Barriers Against Products Granted

The signing of the reciprocal trade agreement with Canada has revived interest in the broad program of similar treaties on which the State Department has been working quietly for many months. While details of the Canadian agreement have not yet been announced, it is believed that substantial reductions of Canadian barriers against American automobiles and parts will be effected.

Other countries with which similar
(Turn to page 649, please)

Significance of Added Agents to Motor Lubricants Questionable, API Told

Special wire to AUTOMOTIVE INDUSTRIES

Last year at the Dallas meeting, the uppermost topic at the fifteenth annual meeting of the American Petroleum Institute was what was coming out of Washington. This year at the Los Angeles convention, tension on that score has eased considerably and technical sessions are back to normal instead of being under a political shadow.

Almost all the papers that have come and are coming before the API Refining Group revolve around the big question mark of where is the automobile industry trying to take the oil industry and to what extent can the latter guide the former? As was expected, Wednesday's (Nov. 13) high spot was the discussion of motor oils with oil-

ness addition agents. The main trend of the comments made upon the two papers was that the whole subject is extremely confused. If the object of adding chemical dopes to oils is to reduce engine wear, then the data offered in the Davis paper shows wear of such extreme minuteness for both straight and treated oils, that significance is at least highly questionable.

This view was expressed by Drs. Neely of Standard of California, Delbridge of Atlantic and MacKenzie of Texas. Dr. Neely further stated that extreme care had to be taken in judging tests made under single set conditions and cited cases from his own work where changes in temperature or in bearing metals has completely re-

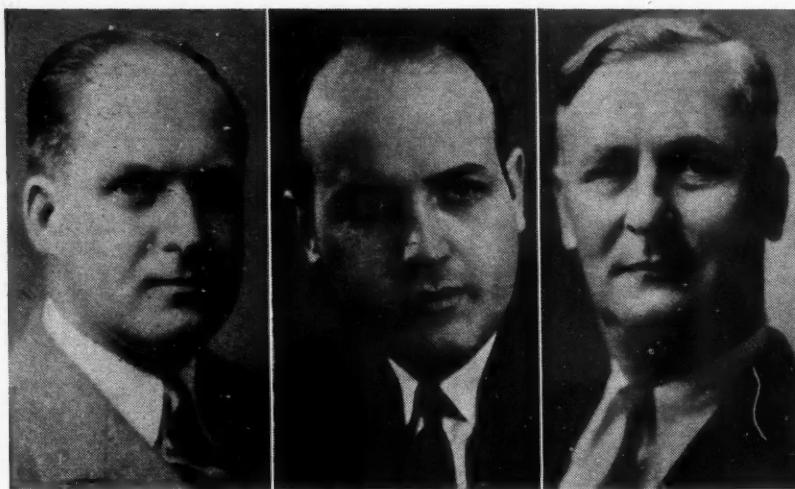
(Turn to page 649, please)

In This Issue

Horizons of Business, Page 652.
Advance Report of American Petroleum Institute Meeting at Los Angeles, Page 654.

Factors Influencing the Durability of Spiral-Bevel Gears for Automobiles, Page 662.

Just Among Ourselves, Page 669.



New vice-presidents of Motor Wheel Corp. Left to right they are J. Harold Hunt, engineering; M. F. Cotes, heater division; John E. Garlent, manufacturing.

All-Steel Top Aids Sheet Production

Some Producers May Not Increase Prices When Upward Revision Occurs

So far nothing has developed to indicate that steel producers do not see eye to eye with reference to upward price revision of prices for flat steels, wire, etc. Here and there one finds conjecture being indulged in, based on the possibility that not all of the steel producers may follow suit when formal announcement of an advance is made.

What has taken place in the last few weeks, has been directly contrary to such an eventuality. The \$1 per ton advance in the price of pig iron in the Chicago market spread with very little delay to the other distributing centers. The same unanimity was noted following announcement of an advance by a midwest producer of semi-finished steel. Some of the finishing mills would undoubtedly like to see the price advance for flat steels so timed that consumers will be limited in the tonnage they can obtain at the lower price to carry over into the next quarter. Others will welcome the opportunity to book business to the maximum of their capacity up to the last minute when old prices will apply to shipments. Sentiment in favor of the mark-up appears, however, to be general among steel producers, and it seems to be taken for granted that sales resistance will be negligible.

Ingot capacity employed this week shows a gain of 3.3 per cent over the preceding week and, taking finishing mills the country over as a whole, operating rates, where they have not been stepped up, have been well maintained. In the Detroit and Cleveland districts, mills catering chiefly to automotive consumers, have all the business they can conveniently handle. A

permanent gain in steel consumption is seen in increasing vogue of the all-steel top.

Pig Iron—Shipments to automotive foundries continue in good volume. One of the paradoxes of the situation is that increased automobile output also makes for an enhanced supply of scrap, thus tending to ease the market for that raw material, fully as essential in the making of steel as is pig iron.

C. E. Wilson Raps False Philosophy Of Boondoggling in Detroit Speech

The false philosophy of boondoggling was rapped in a talk by GM's C. E. Wilson at the Armistice Day meeting of the Detroit Section, SAE. Mr. Wilson told his audience there is an impression pervading the country that any one perfecting a machine to produce an article with less human effort is guilty of an unsocial act. Engineers, he said, have the right to feel they have contributed to the advance in living standards and the well-being of the nation.

Mr. Wilson spoke at the evening session of the Section. In the afternoon there was a meeting for students, followed by a dinner at which E. V. Rippington, GMR executive, presided.

"There has been a certain false philosophy abroad in the country to the effect that anyone who effects a better way of doing something, or perfects a machine for producing, or produces a superior product with less human effort, is doing something unsocial," Mr. Wilson said. "Boondoggling is the natural complement to this theory and false philosophy. As engineers you have the right to feel that you are doing your part in advancing the scale of living in the country, and the well-being of the nation.

"The men have been put to work by the automotive industry, both in the industry itself and in allied machine tool

Aluminum—No change is noted in the market for primary aluminum. Secondary metal moves in orderly fashion, demand for remelted No. 12 alloy predominating.

Copper—Domestic consumers continue to call for immediate shipment of metal, originally contracted for to be delivered over the last quarter. The general expectation is that all 1935 commitments, now on the books of refineries, will have been cleaned up before their maturity. Light export demand makes for stationary price conditions.

Tin—A strong bear sentiment appears to have developed in London metal brokerage circles, where prevailing prices are looked upon as artificially maintained and declines freely predicted. The New York market for spot Straits tin was nominally quoted at 52½ cents at the week's opening.

Lead—Some buyers, urgently in need of lead, are reported to be paying a premium for spot deliveries. The market rules quite active and strong.

Link-Belt to Move

The executive offices of Link-Belt Co. of Chicago will be removed November 30 to the Bell Building on North Michigan Avenue. The company's present offices are in the Standard Oil Building at 910 South Michigan Avenue.

Bowers Joins Young

F. W. Bowers has joined the Young Radiator Co. as plant manager, according to an announcement by F. M. Young, president. Formerly Mr. Bowers was associated with the White Motor Co., the Indiana Truck Co. and the Apperson Automobile Co.

industry, etc., have produced something useful and of great social value, and have made it possible for hundreds of thousands of people to enjoy motor cars, and have themselves in the meantime made good livings, while if the industry had not taken a progressive development point of view fewer cars would have been produced—they would have been inferior cars, and many thousands of people would have to go without jobs, and other thousands without cars."

The daylight technical session was planned chiefly for the students. Walter T. Fishleigh spoke on "What Price Progress?" Among other things he pointed out that the engineer's job in the future must go far beyond the usual conception of mathematics and designing ability. Engineers of the future will have to consider art and color, economics, politics, and human relationships, Mr. Fishleigh said.

"Fundamentals of Recent Spring Suspension Developments" was presented by N. E. Hendrickson, vice-president and chief engineer, Mather Spring Co. He stressed particularly the advances made in spring design and the improvements evident in spring steel manufacture. Spring steels today are noted for precise uniformity of size, hardness, and load-carrying capacity. Alloy springs are used almost exclu-

sively because of their ability to provide an elastic limit ranging from 160,000 to 200,000 lb. per sq. in., Mr. Hendrickson pointed out.

R. N. Janeway, Chrysler research engineer, was chairman of the student meeting.

Mexico Plans Check on Stolen Car Entry

New Customs Regulations Require Positive Proof Of Ownership, Description

Automotive men and United States Customs authorities on the Rio Grande border believe the new regulations of the Mexican Government governing the entry of cars into that country will do much toward stopping the wholesale crossing of stolen automobiles into Mexico.

In addition to a complete description of each car, there must be filed in the Mexican custom office proof of ownership. Persons on trips to Mexico are advised to bring with them papers accrediting ownership of the car, such as license receipt, bill of sale or title. Another requirement is that the make, serial number and size of each tire, both on the car and all extras, must be stated on the permit. This means that all casings, even if blown out during the trip in Mexico, must be returned to the border and checked out; otherwise duty will have to be paid.

The regulations covering entry of cars have been simplified. The term of a permit has been extended to six months and the fee reduced to three pesos, equivalent to about 85 cents United States money. Private car bonding offices on the border have been discontinued. It is required that when leaving Mexico the car owner present the permit to the Mexican customs for cancellation, and in case he leaves the country through a different port of entry, he must notify the original port a fortnight ahead of such intention, so that documents can be forwarded to the place of intended departure.

November Show-Advertising Linage 27% Ahead of Jan. Exhibition Space

Automobile advertising in New York and Brooklyn newspapers for this year's show increased 27 per cent (on a six day basis) on a linage measurement over the space used by automotive companies for last January's show, according to a compilation made by Media Records, Inc., and published in *Editor and Publisher*.

From Nov. 1 to 6 automobile companies used 391,615 lines of newspaper space against 267,296 for Jan. 4 to 9. This is an increase of 124,319 lines. The accompanying tabulation shows the distribution of the 1936 show week space compared with that for the show held last January.

	Nov. 1-9, 1936	Jan. 4-9, 1935	Biggest Day Nov. Show	Biggest Day Jan. Show
Times	67,346	52,276	38,710	39,552
Herald-Tribune	68,397	47,555	40,974	40,012
American	42,111	28,380	21,980	25,390
News	27,109	15,721	14,902	10,761
Mirror	16,512	7,969	9,519	6,254
Journal	37,613	26,615	16,595	17,321
Post	15,778	9,197	12,291	6,747
Sun	43,039	32,915	26,949	21,268
World-Telegram	42,925	28,090	22,036	19,029
Brooklyn Eagle	18,883	11,571	10,087	7,533
Brooklyn Times-Union	11,938	7,007	7,574	5,488
Total	391,615	267,296		
Gain	124,319	lines		
Gain, per cent	27%	on six day basis		
Total, Jan. 5-10, 1935	385,198			
Total, Jan. 6-11, 1936	325,540			

MESA Demands Recognition, Wage Boost at Mather Co.

The combination of a steel price said to amount to approximately one dollar per day per man and a strike of worker members of the MESA has forced the closing of the Mather Spring Co. in Toledo. About 100 of the 425 workers in the plant walked out two weeks ago.

Contracts between the Mather Company and Chrysler, Hudson and Ford have been turned over to competitor companies for execution. Company officials have indicated they do not intend reopening the plant until conditions appear more favorable.

L. S. Harding, secretary of the Toledo Industrial Peace Board, has sought to bring about some form of mediation, but company officials indicate they are in no position to deal with any organized group and are reported to have refused to deal with any

but their own employees. The MESA is demanding union recognition, union contract, wage increase, over-time bonus and elimination of speed-up systems. The Mather Co. recently granted a five per cent wage increase.

Gordon M. Mather, president, is ill and probably will spend the winter months in the south. In his absence George B. Secor, secretary and sales manager, has been in charge of the plant and all negotiations.

40 Years Ago

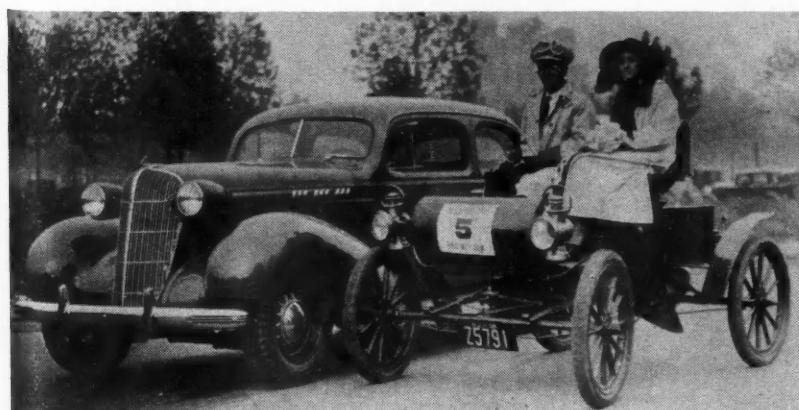
with the ancestors of AUTOMOTIVE INDUSTRIES

"Talking of horseless vehicles suggests to my mind that the horse is doomed . . . the horseless vehicle is the coming wonder," said Thos. A. Edison in November, 1895. "Ten years from now you will be able to buy a horseless vehicle for what you would have to pay today for a wagon and a pair of horses. The money spent in the keep of the horses will be saved, and the danger to life will be much reduced."

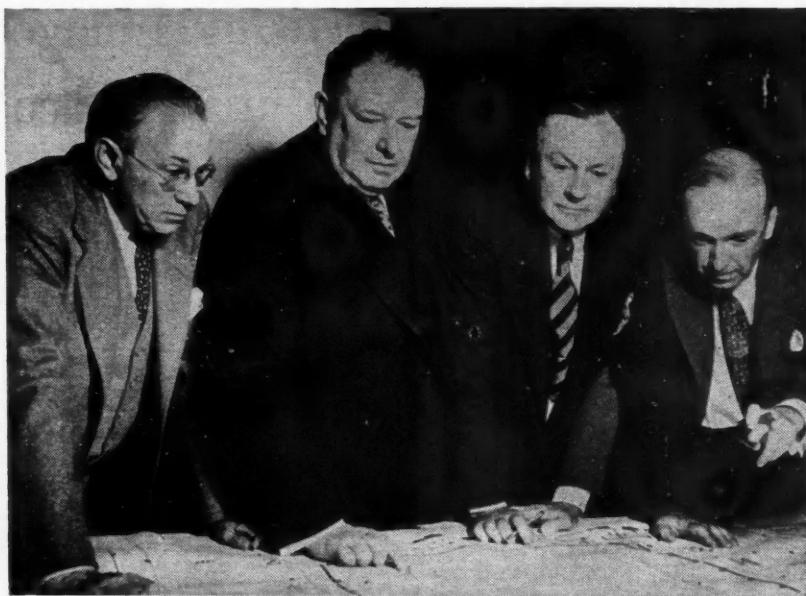
With the optimism already characteristic of the industry the editor added, "Had Mr. Edison read the first number of *The Horseless Age*, he would have said ten months rather than ten years."

Mr. Edison did not believe that these new vehicles would be run by electricity. He said: "It is quite possible that an electrical storage battery will be discovered which will prove more economical, but at present the gasoline or naphtha motor looks more promising."

—*The Horseless Age*, Dec., 1895.



An Oldsmobile today and yesterday. On the right one of the entries in the jalopy derby featuring the opening of Philadelphia's Automobile Show last Monday.



Chicago Automobile Show committmen plan \$3,000,000 exhibition. Left to right they are: A. C. Faeh, show manager; H. T. Hollingshead, committee chairman; H. K. Kenderdine, president of Chicago Auto Trade Association, and M. J. Lannan, director of CATA.

Chicago's \$3,000,000 Show Opens; 29 Car, 40 Parts Makers Exhibit

Chicago's thirty-sixth annual automobile show, heralded as the "biggest thing the motor industry has ever attempted to stage" gets under way today at the new Stock Yards International Ampitheatre. This show is reported to have cost \$3,000,000.

For the first time in the history of Chicago shows, exhibitors will display all their models at the one show. In the past, space limitations have necessitated private showings at various Loop hotels. This show, like last February's, is under the sponsorship of the Chicago Auto Trades Association, with Al Faeh as manager.

Many events have been scheduled by car companies for the period of show week. In addition to these affairs, mostly dealer sales meetings which will be found listed elsewhere in this issue, the Chicago Section, SAE, the NADA and the AAA have planned meetings. The SAE will give a dinner at the Stock Yards Inn, Monday night, with William B. Stout, national president, as the feature speaker. Robert T. Hendrickson, Chicago chairman, will preside. On Monday the NADA opens its annual convention at the Congress Hotel.

Pre-show events featured the annual dinner of the AAA in Palmer House, with Governor Harold G. Hoffman of New Jersey as principal speaker. The three A's convention began Friday morning, with Thomas P. Henry, president, in the chair.

Auburn, Bentley, Buick, Cadillac, Chevrolet, Chrysler, Cord, DeSoto, Diesel, Dodge, Duesenberg, Ford, Graham-Paige, Hudson, Hupmobile, LaFayette,

LaSalle, Lincoln, Nash, Oldsmobile, Packard, Pierce-Arrow, Plymouth, Pontiac, Reo, Rolls Royce, Studebaker, Terraplane and Willys are exhibiting.

Trucks that will be exhibited will be: Chevrolet, Dodge, Ford, Reo, Mack and International.

Trailer exhibitors who will be on hand are: Bowles-Teller, B. & J., Covered Wagon, Kozy Coaches and Wolfe Bodies.

About 40 parts and equipment manufacturers will have displays.

Champion Spark Plug Co. to Enlarge Toledo Plant

The Champion Spark Plug Co. this week awarded a contract for a new five-story addition to its Toledo plant which will increase manufacturing capacity by more than 30 per cent. The structure will be of steel and concrete with 140 feet frontage on Upton Avenue and 60 feet depth.

Chevrolet Expects Big Holiday Sales, Holler

Chevrolet is looking forward to the highest volume of Christmas sales in its 25-year history, according to W. E. Holler, vice-president and general sales manager.

Employment in 51 Toledo plants was 18,781 at the beginning of the week compared with 18,197 at the same time last year. However, a decline of 720 for the current week was recorded largely due to the Mather strike.

Independent Labor Group Merger Nears

Some AFL Locals May Join AAWA, MESA, AIWA and Dingmen

Merger of four independent labor unions in the motor industry into a single organization to be known as the Automobile and Metal Workers Industrial Union neared consummation as favorable referendum votes were reported by the locals of the various groups involved.

Representatives of the Associated Automobile Workers of America, the Mechanics Educational Society and the Automotive Industrial Workers Association, the leading independent groups, had met Nov. 3 and agreed upon amalgamation, subject to ratification of members. The Dingmen's Club later signified its intention to merge and is polling its members on the question Sunday. Several locals of the AFL have asked to be represented at the constitutional convention to be held in Detroit, Dec. 21, according to leaders in the movement.

Most of the AAWA locals have voted, and unanimously favored the merger. All MESA locals heard from to date, voiced approval. No opposition was anticipated in the AIWA organization and representatives of the Dingmen's Club were equally confident of a favorable vote tomorrow.

Each of the unions, except the Dingmen's Club, was represented at the Nov. 3 conference by 15 delegates. The following temporary officers were elected: T. W. Woody, head of the AAWA local at the General Motors truck plant at Pontiac was made president. Mathew Smith, secretary of the MESA, was named secretary, and Richard Franksteen, head of the AIWA local at the Dodge plant, was elected treasurer. These officers together with two members from each union composed a committee to draft a constitution which is to be voted on at the organization meeting Dec. 21. This convention, which also will elect permanent officers, will be limited to 150 delegates apportioned among the groups on a per capita membership basis.

Mail, Passengers, Express Carried by 26 Plane Cos.

There were 26 companies engaged in the transportation of mail, passengers and express by air in the United States as of July 1, according to a report on "Civil Aeronautics," prepared by Eugene L. Vidal, director of the Bureau of Air Commerce. The report, just released by the Government Printing Office, explains that 109 services were being operated by these companies to points in the U. S. and to foreign countries in the Western Hemisphere. Mail

was being transported over 74 routes, passengers over 106 and express over all of the 109 routes.

Pilots Federally licensed number about 14,000 and mechanics 8000, according to the report. Scheduled airlines employ 571 first pilots and 330 second pilots, the total number of professional pilots being unobtainable.

The report reviews the production, exports, technical and safety record of the aircraft-manufacturing industry and of the scheduled airlines, and brings up to date the map of scheduled airways in the U. S.

Motor Co. Earnings

Earnings of various automotive companies for the period ending Sept. 30, 1935, compared with the same period of 1934, are as follows:

Hudson Motor Car Co., net loss, \$250,561; net loss, \$1,563,144.
Reo Motor Car Co., net loss, \$51,186; net loss, \$907,483.
Hupp Motor Corp., net loss, \$2,521,410; net loss, \$2,403,361.
Checker Cab Manufacturing Corp., net loss, \$122,480; net loss, \$441,469.
Thompson Products, Inc., net profit, \$528,713; net profit, \$471,806.
Boeing Airplane Co., net loss, \$591,993.
Wright Aeronautical Corp., net profit, \$245,065; net profit, \$838,251.
Curtis-Wright Corp., net loss, \$192,705; net profit, \$584,829.
United American Bosch Corp., net profit, \$105,469; net profit, \$137,489.

Extra Bendix Dividend

Directors of the Bendix Aviation Corp. have declared a dividend of 25 cents. This is the first payment since April, 1932, when a dividend of 15 cents was paid. A special dividend of 50 cents has been declared by the Link-Belt Co. Including other dividends previously paid, total dividends of the company will amount to \$1.20 a share on the common stock.

Parker Rustproof Stockholders Vote On Metal Research Corp. Merger

A special meeting of stockholders of Parker Rustproof Co. has been called for Dec. 5 to ratify action of directors in authorizing consolidation with Parker of the Metal Finishing Research Corp. of Detroit. Plan calls for acquisition by the Parker Company of all the assets of the Metal Finishing Research Corp. in exchange for Parker stock on basis of one share of Parker common for each three and one-fifth shares of Metal Finishing common stock outstanding.

It is proposed to increase the authorized common stock of Parker Rustproof to 500,000 shares and then to declare a stock dividend of two shares for each share of Parker stock held. Upon completion of the consolidation and distribution of stock dividends, Parker Rustproof will have around 400,000 shares outstanding. It is planned to apply for listing of the Parker shares

GM October Sales Set Record; Top '29 Total by 5000 Units

General Motors' October sales to dealers in the United States and Canada plus overseas shipments were the largest for any similar month on record, eclipsing the 1929 total, the previous high, by approximately 5000 units. World sales last month totaled 127,054 units compared with 39,152 in September; 72,050 for October last year and 122,104 for the same month of 1929. The gain in sales can be partially accounted for by early announcement of new models.

Sales to United States dealers were more than four times greater than in the previous month and came within a few thousand units of doubling the previous

October record. Consumer sales were slightly above the September figure, 68,566 to 66,547, thus building up dealer inventories which have been an uncertain quantity because of the high consumer demand during the year.

The corporation's sales for January-October period this year eclipsed by approximately 100,000 units the total sales for the whole of the preceding year. The 10 months' sale this year was 1,347,236 against 1,137,816 for the same period last year, while the year's total for 1934 was 1,240,447.

The accompanying table shows General Motors' sales figures in detail.

	Oct., 1935	Oct., 1934	10 Mos., 1935	10 Mos., 1934
Sales to U. S. dealers.....	97,746	22,986	50,514	1,073,075
Sales to U. S. consumers.....	68,566	66,547	69,090	1,019,939
Change in dealer inventories..	+29,180	-43,561	-18,576	+53,136
Canada and overseas sales..	29,308	16,166	21,536	274,161
World sales	127,054	38,152	72,050	1,347,236

Conclude Fruehauf Hearings

Hearings held in Detroit by the National Labor Relations Board on the Fruehauf Trailer case were concluded on Friday last week and decision is to be announced from Washington in the near future. Joseph Warren Madden, NLRB chairman, allowed counsel 10 days in which to present written arguments and gave Hal H. Smith, counsel for the Michigan Manufacturers Association, permission to intervene and present a brief in behalf of that organization.

First Motor Carriers Ask ICC Certificates

Applications for certificates of operation were made by five motor common carriers and applications for permits were made by two contract motor carriers with the Interstate Commerce Commission Wednesday of this week. Two of the common carrier applications were made by passenger coach companies.

Kellogg Reorganized

The Kellogg Compressor & Manufacturing Corp. has been incorporated under the laws of the State of New York to take over all the assets of the Kellogg Manufacturing Co. J. F. Weller has been named president.

Associated with Mr. Weller in the new organization will be such old associates as John J. Sharp, H. Osgood Holland, George B. Collins, Nicholas Arnold and Dan Bohannon.

Chevrolet salesmen in India have used tom-tom drums in rural communities to attract crowds of prospects.

One of the new armored trucks used by New York's Finance Department to distribute payrolls to city workers. The above photograph shows the first pay being dispensed.



"Largest Retail Selling Show," Reeves Says

Alfred Reeves, AMA general manager and manager of the New York Show, has announced that the first fall show proved to be "the largest retail selling show since 1929." Some companies, Mr. Reeves said, "have almost doubled their sales with the average more than 60 per cent above those for the show last January."

Holding the show in the fall "permits the industry to enjoy a bigger portion of the Christmas trade than it has in past years," the show manager stated.

Argentine Motor Imports 95.8% U. S. Manufacture

Argentina's imports of motor vehicles in the first nine months of the current year have increased 40 per cent as compared with the corresponding period of 1934 the American consulate-general at Buenos Aires reports to the Commerce Department.

During the 1935 period the number of motor vehicles entering the country totaled 19,705, of which 18,895, or 95.8 per cent, were of American manufacture. Imports of passenger cars in January-September period totaled 13,312 units, an increase of 42 per cent

Skilled Labor Shortage Emphasizing Urgency of Apprentice Training Need

A looming shortage of skilled artisans is emphasizing the urgency for apprentice training in industry, Detroit manufacturers were told at a recent conference of industrial and educational leaders sponsored by the Michigan Manufacturers Association, National Metal Trades Association and Employers Association of Detroit.

S. Wells Utley, president of Detroit Steel Castings Co., told the conferees: "We are faced with a strange paradox. While 9,000,000 are unemployed in this country and the curve of industrial production is only 80 per cent to 85 per cent of normal, there is a universal complaint of a shortage of skilled labor. American industry was built on foreign skill and never has had adequate apprenticeship training."

A resolution was adopted unanimously calling upon Detroit manufacturers to establish apprentice training systems in their respective plants and to employ as many apprentices as operations would warrant and trade needs require. A committee named to thoroughly survey the Detroit situation and formulate a definite plan of procedure for apprentice training in cooperation with public educational officials, reported that more than 66,000 workmen are engaged in 10 skilled trades in Detroit; that about five per cent of these disappear annually through promotion, superannuation, death and other natural causes. It was estimated that it will be necessary to train upwards of 3300 young men annually if the number of skilled workmen is to remain at even the present level.

over the corresponding 1934 total. Arrivals of trucks amounted to 6393 units, an advance of 25.2 per cent over last year's figure. American makes accounted for 12,860 automobiles and 6035 trucks in the period under review.



Dealers Get Break on Christmas Buying With Advanced Show Date

Cars as Christmas gifts will assume a new importance this year. Merchandising efforts along this line have been often fruitless in the past because of the imminence of the New York show and the new model announcements. This year dealers are planning to take advantage of the fact that the gift season comes at a time when their showrooms are full of new models.

Dealers in the South are probably the happiest because of the change in show dates. For many years they have been advocating the change, and believe their business will benefit substantially from it. Those in resort sections of the South are also counting on the tourist trade, which should provide sales opportunities as soon as the visitors begin

arriving for the winter season.

Dealers in the "snow zone" are also counting on an increase in Christmas buying. They point out that most owners no longer lay up their cars during the winter months, so there should be almost as many good prospects in the Northern states as in the South.

Reports of dealer opinion in the farming regions are more diverse. The time to sell cars to the farmer is when he has cashed in on his crops. In most parts of the country this happens in the early fall, which has now become the before-new-models dull season. But many farm zone dealers think the farmer will not mind waiting a few weeks and will still have enough money to buy a new car.

ously calling upon Detroit manufacturers to establish apprentice training systems in their respective plants and to employ as many apprentices as operations would warrant and trade needs require. A committee named to thoroughly survey the Detroit situation and formulate a definite plan of procedure for apprentice training in cooperation with public educational officials, reported that more than 66,000 workmen are engaged in 10 skilled trades in Detroit; that about five per cent of these disappear annually through promotion, superannuation, death and other natural causes. It was estimated that it will be necessary to train upwards of 3300 young men annually if the number of skilled workmen is to remain at even the present level.

Mills Assigns Shares in Auto Stamping to Bank

A block of 26,975 shares of City Auto Stamping Co. stock was released from the closed Security-Home Trust Co., in Toledo, when a settlement of a debt owed to the bank by Raleigh D. Mills, vice-president and director of the company, was approved by Common Pleas Court.

Under the terms of the agreement Mr. Mills was released from collateral, unsecured and mortgage notes aggregating \$216,477 and accrued interest of \$39,066 to Nov. 1, given the security for the notes and \$15,000 in return for the release to the bank of the City Auto Stamping shares. He cooperated with the bank in negotiating a sale of the stock at a price approximately the market value or near \$10 a share. New York interests are reported to have participated in the transaction.

It is not felt that the sale of the stock will affect the control of the company, but will lift the load of stock which has been overhanging the market for many months. The company has 375,000 shares of common outstanding. A considerable block is reported held by the C. O. Miniger interests.

The market responded to the sale with shares rising to 11½ on the New York Curb.

Rim Inspections Gain

Rim inspections for the January-October period this year totaled 14,944,573 which compares with 10,557,853 for the corresponding 1934 period. October inspections were 1,648,757 against 629,565 for the same month last year. These figures are reported by the Tire and Rim Association, Inc.

In all of Spitzbergen, there is only one motor vehicle—a truck. The figure is of January 1, 1933, the latest available.

SHOW POSTSCRIPTS



(Above) Harry G. Moock, Plymouth vice-president, left, and R. N. Rowland, Chrysler eastern division sales manager at Chrysler preview.



(Left) W. C. Cowling, Ford sales manager, standing, and A. S. Hatch, Lincoln sales manager, snapped at Ford-Lincoln press breakfast.

Automotive Industries Photos



(Above) Byron C. Foy, Chrysler vice-president, in foreground, shows new DeSoto to two friends at preview.



(In circle) C. A. Esslinger, manager, Ford Edgewater plant, left, and C. A. Musselman, right, president of Chilton Co., at Lincoln Zephyr preview.

(Below) Major Bowes, center, with his new Cadillac, the first car sold after show opening. With him are J. C. Chick, left, Cadillac sales manager, and Nicholas Dreystadt, right, Cadillac general manager.



(Above) March of Time broadcast, feature of SAE annual dinner program.



Ralph Teeter, SAE president-elect, introduced to Society diners.





Wide World Photo

A Soviet Army tank demonstrates its durability by flying through space after scaling a high obstacle.

Energetic Safety Program Shaping

AMA, National Council, Harvard Bureau, Seen Concentrating Efforts

Efforts of the Automobile Manufacturers Association, the National Safety Council, Harvard Bureau for Street Traffic Research and all other organizations interested in advancing highway safety are gradually crystallizing into an energetic, comprehensive program.

Alvan Macauley, AMA and Packard president, announced this week that the car maker's organization will offer further assistance to the Harvard Bureau in its work to reduce the annual national accident toll on highways. At the same time it is understood there was a meeting in Chicago yesterday (Friday, Nov. 15) between AMA officials and officers of the National Safety Council to discuss arrangements for more concerted action on this moot topic.

In addition to the work being carried on and planned by these organizations, Coleman W. Roberts, chairman of the AAA's committee on roadside safety, told his group in New York this week, that anything along highways distracting the driver's attention was hazardous. Mr. Coleman went to Chicago for the AAA's annual meeting yesterday to lay before the main body of the association a resolution calling for the presentation to state legislatures of a draft of a model statute for highway control.

In his announcement of further aiding the the Harvard Bureau, Mr. Macauley said the automobile industry is constantly striving to build safer vehicles and that through its unremitting study and experimentation, safety glass had been developed, vision improved and brakes perfected. Mr. Macauley said that it is because the AMA is convinced of the soundness of this

approach to the problem, that the association has offered the Harvard Bureau further cooperation in expanding its technical attack upon traffic and safety problems.

Solid backing for the current drive toward greater highway safety was assured with the formation of the Pontiac Safety Men, the membership embracing the entire field wholesale organization of the Pontiac Motor Co. From this nucleus it is hoped to enlist as active proponents of safe driving every Pontiac dealer and salesman in the United States by bringing an organization of thousands of people into the work of reducing highway accidents.

The Pontiac Safety Men were organized during a recent convention at the factory and H. J. Klinger, president and general manager of the Pontiac, was named honorary president.

Estimated 984,000 In Last Quarter

(Continued from page 641)

ber schedules which should bring an output of 350,000 units and there is every indication that December's production will be equally large. In other words, the final two months of the year should account for 700,000 units which added to the 284,000 turned out in October gives a fourth quarter production of 984,000 vehicles, exceeding even that of the final quarter in the boom year, 1929, and surpassed only by the record fourth quarter of 1925 when 1,115,440 units were built.

Production in the first nine months this year for which official figures are available was 3,066,449 units. If the current quarter's estimate is realized, the year's total should reach 4,050,000 cars and trucks, the biggest year's output since 1929. Unless there is a sharp let-down in retail sales as winter sets in, there is no reason to believe that December operations will not parallel the November rate, at least

most manufacturers plan to hold to the present level and some are hoping to reach even a faster clip next month.

With a large bank of shipping orders still unfilled, Packard says orders from distributors and dealers are being received as fast as cars are being shipped. New all-time records for production and shipments were made in October it was announced by the company. The first 10 days of November indicate satisfactory sales and deliveries through November, M. M. Gilman, vice-president and general manager of the company, said. He added that results now being obtained from the automobile shows are encouraging from the standpoint of immediate sales and future business. October shipments of 7039 cars set a new monthly record as did production with 6964 units. Domestic retail sales of 6137 were the largest since August, 1929, and represented the largest October sales in the company's history. An actual shortage of cars now exists among some body models, Mr. Gilman said.

Shipping orders at the factory still equal a whole month's production despite the high rate of output which has been maintained since the announcement of the new models in September. Present indications are that production for 1935 will exceed 50,000 cars, despite the fact that full operations on the new 120 car were not attained much before April. If the estimated production is reached it will make one of the largest years in Packard history.

New Car Registrations

New car registrations in 19 States for October amounted to 36,913 as against 35,989 a year ago. While total sales show a slight increase of about 3 per cent over last year it is interesting to note that for these 19 States all three of the big sellers in the low-price field are so far showing a loss over last year. Chevrolet with 10,229 as compared with 10,621 has a decrease of about 4 per cent for the 19 States; Ford a decline of approximately 7 per cent with 9803 as compared with 10,488, and Plymouth a loss of about 25 per cent in these 19 States.

Pontiac

New York show sales totaled 501, compares with 301 during January, 1935, show. . . . Factory production schedule increased to 59,000 units by Jan. 1. . . . October output, 16,663 cars. . . . November shipping orders, 19,600 cars.

Buick

New York dealers report 548 sales during show week. . . . Compares with 145 for last January's show. . . . Breakdown, 280 series 40; 110 series 60; 125 80's, 33 limited 90's. . . . Retail deliveries in October, 14,164 cars, largest month in five years.

Hudson

Daily production rate—700 cars in final quarter. . . . Output will exceed original schedule. . . . New York show sales, including Terraplanes, doubled total of January show.

Chevrolet

October production, 69,128 units, gain of 23 per cent over same month 1934.

Significance of Added Agents Questionable

(Continued from page 641)

versed the apparent order of merit of oils. Also that while some addition agents reduce wear when fairly new, as the oil is used they change, and later greatly increase wear.

Dr. Delbridge probably gave the best summary, saying that we are on the threshold of a subject of great complexity, but which probably will lead us ultimately to a better understanding of lubrication and perhaps to better lubricants.

A vigorous discussion is expected tomorrow (Thursday, Nov. 14) on the report of the recently created Automotive Survey Committee. This report emphasizes the difficulties facing the petroleum industry due to rapidly increasing octane requirement of new cars, need for special lubricants, bearing of easily corroded alloys and especially fuel handling systems that limit the starting and accelerative qualities of gasoline.

Almost simultaneously with this report will be read the Coombs paper which shows how elaborate the equipment of an adequate greasing station has become and how the time to do a good greasing job has increased. The main tenor of this paper and of the survey report is that automobile manu-

facturers could, if they would, help keep down the cost to the public of petroleum products and of the services connected with them.

Over 220 members have already registered, and in addition are many local oil men. For Wednesday morning's technical session, the huge ballroom of the Biltmore Hotel was crowded to capacity and the promise is for an even denser throng tomorrow.

New Car Financing

Correction

Milan V. Ayres, secretary of the National Association of Sales Finance Companies, has called our attention to a misinterpretation of dollar-volume new-car financing which appeared on p. 614 of the Nov. 9 issue of AUTOMOTIVE INDUSTRIES. We said: "The decline in dollar volume of new-car financing for the first eight months of the current year was \$88,000,000 below that for the corresponding months of 1934."

We should have said, quoting: "If last year's ratio [of new-car financing to new-car sales] had remained effective this year, the reporting companies would have financed [our italics], during the first eight months . . . an additional \$88,000,000 of retail paper." To Mr. Ayres and our readers, an apology.

U. S.-Canadian Pact Believed Motor Aid

(Continued from page 641)

treaties are in process of negotiation are Spain, France, Switzerland, the Netherlands, Honduras and Guatemala. It is expected that agreements with many if not all of these nations will be concluded before the end of the year.

A correspondent of AUTOMOTIVE INDUSTRIES reports from Barcelona, Spain, that rumors are current to the effect that negotiations under way for more than a year between that country and the United States have at last been concluded, and announcement of the agreement is expected shortly. Tariff barriers which have seriously reduced imports of American cars for many years will be removed. Trucks, tractors and parts are also expected to benefit from the new treaty, in return for considerable concessions to Spanish agricultural and other products, non-competitive with the automotive industry. The American Chamber of Commerce in Spain, of which General Motors Peninsular, Ford Motors Iberica, and distributors of other American automobile manufacturers are members, raised a fund of 15,500 pesetas for research work which has facilitated the work of the United States Embassy in Madrid during the negotiations.



Paul G. Hoffman, Studebaker president, and Lewis L. Strauss of Kuhn, Loeb



D. P. Brother, left, and T. E. Ralston, Jr., Olds v.p. at GM show



The Grahams, left to right—Tom, Ziba, Robert, père; Robert, Jr.



At the Nash meeting. Left to right, C. W. Nash, Richard Israel, N. Y. distributor; E. H. McCarty, Nash president; Courtney Johnson, Nash sales manager. (Below)



General view of Ford show in Hotel Astor, New York.

French SAE Seeks Low-Cost Small Car

Fifty Designs Submitted in Competition; Plan Is for Two-Passenger Unit

PARIS (by mail)—A popular two-passenger automobile having the following characteristics—speed 47 m.p.h., gas consumption 75 miles to the gallon; maintenance costs \$20 per month for a distance of 600 miles; purchase price \$600, is being sponsored by the French Society of Automotive Engineers. A competition has been opened, about fifty designs have been sent in and these are being examined by a jury.

M. Maurice Goudard, who is responsible for this initiative states that the idea is to produce a cheap type of automobile which will not compete with anything on the market. He wants to appeal to an entirely new class of buyers who cannot enter the new car field because of purchase price and are not interested in used cars because of maintenance charges.

A two-seater closed car is desired although there is considerable opposition to this among salesmen, who declare that the public require four seats. The answer is that a four seater cannot be a really economical car and that there are plenty of four seaters at present on the market.

While the purchase price fixed by the French engineering society appears high, it should be remembered that there is no car in France at the present time selling for less than \$870.

Three of the biggest makers have already built experimental models to fit this program. It is not known, however, if they will be launched, for there is a feeling that to throw a quantity of small cheap cars on the market at the present time would have a very disturbing effect on the used

An impromptu conference at New York Show—unaware of the candid camera. Left to right, Harlow H. Curtice, Buick president; F. B. Davis, president, U. S. Rubber Co., and Emmet Sheahan, general manager, U. S. Tire factory in Detroit.



car situation. It seems certain, however, that a cheap two-seater runabout will be on the French market within the next year.

Dictionary of Symbols To be Compiled by ASA

The Committee on Symbols and Abbreviations of the American Standards Associations has been reorganized and will begin immediately the compilation of a new dictionary of letter symbols and abbreviations, according to a recent ASA announcement.

Twelve standards for letter symbols, abbreviations and graphical symbols have been developed by the technical committee of the association. Recently, to simplify the committee's work, it was divided into two parts, one covering the letter symbols and abbreviations and the second covering the graphical symbols.

Cuba's First Automobile Show Planned for Jan.

Cuba may have its first automobile show, staged in conjunction with the "Feria de la Habana" and housed in a building on the exposition grounds, according to a report to the Commerce Department from Kathleen Molesworth,

assistant Trade Commissioner stationed at Havana. Sponsors of the "Feria," which opens early in January, hope that not only car and truck makers will participate with displays, but that tire, parts and equipment makers also will arrange for exhibits, Miss Molesworth stated.

Car Prices in lb., h.p., W-b. Show Big Decreases

The average price today of an automobile is 23 cents per pound, according to a cost analysis just completed by the AMA. This figure represents a decrease of 44 per cent from the average price in 1925. Ten years ago the average car price was \$31.50 per h.p. and today that average has dropped 75 per cent, or \$7.80 per h.p.

If inches of wheel base be used as the standard, according to the analysis, the figures show that where 10 years ago the average price of an automobile was \$9.60 per inch, today it is \$5.90, a decrease of 39 per cent.

Speed Governor Tampering Prohibited in Pennsylvania

Tampering with governors on automobiles, trucks and other motor driven equipment of the Pennsylvania Department of Highways has brought a strict warning from Warren Van Dyke, secretary.

In orders issued to the field today, the secretary pointed out that these governors are placed and adjusted by the manufacturers to prevent racing of motors and prolong the life of the equipment. Such tampering will not be tolerated, he said, although provisions are made for necessary adjustments by district mechanics who will report all changes to the central office.

Hoffman, Frank Abroad For Dealer Meetings

Paul G. Hoffman, president of Studebaker Corp., with Mrs. Hoffman and A. H. Frank, Studebaker export manager, left New York, Wednesday for Quebec, where they were to board the Empress of Britain on Thursday for a short business trip to Europe. Their purpose was to take part in the introduction of the new Studebakers in Europe. Mr. Hoffman will address a meeting of the company's European

CALENDAR OF COMING EVENTS

SHOWS

Detroit Automobile Show	Nov. 9-16
Buffalo Automobile Show	Nov. 9-16
Indianapolis Automobile Show...	Nov. 9-16
Newark Automobile Show	Nov. 9-16
Toronto, Ont., Automobile Show...	Nov. 9-16
Cincinnati Automobile Show	Nov. 10-16
Pittsburgh Automobile Show.....	Nov. 11-16
Philadelphia Automobile Show...	Nov. 11-16
Toledo Automobile Show	Nov. 15-21
Chicago Automobile Show	Nov. 16-23
Portland, Ore., Automobile Show.	Nov. 16-23
Minneapolis Automobile Show....	Nov. 16-23
Columbus Automobile Show ...	Nov. 22-28
Cleveland Automobile Show ...	Nov. 23-30
Montreal Automobile Show	Nov. 23-30
Peoria, Ill. Automobile Show...Nov.	27-Dec. 6
Kansas City Automobile Show,	
	Nov. 30-Dec. 6

CONVENTIONS AND MEETINGS

S.A.E. Pacific Regional Meeting, San Francisco	Nov. 18-19
Natl. Foreign Trade Convention — Houston	Nov. 18-20
Overseas Automotive Club, Annual Dinner, Ritz-Carlton Hotel—Atlantic City	Dec. 11
S.A.E. Annual Meeting, Detroit, Jan. 13-17, 1936	
American Roadbuilders Assoc., Cleveland	Jan. 20-24
U. S. Chamber of Commerce, Annual Meeting, Washington.....	April 27-30

dealers in Brussels Nov. 16 and a meeting of British dealers in London Nov. 18.

Plans will be developed in Brussels to take full advantage of the reciprocal trade agreement signed by Belgium and United States last summer under the Administration's foreign trade policy looking toward an increase of world trade as a whole and American foreign trade in particular. The party is returning on the Europa, sailing Nov. 20.

Industry Congress Dec. 4; Sloan Principal Speaker

Alfred P. Sloan, Jr., GM president, will be the principal speaker at the dinner Dec. 4 opening the annual Congress of American Industry held in conjunction with the annual convention of the National Association of Manufacturers. Others on the list of speakers include J. Warren Madden, chairman, National Labor Relations Board; Dr. Neil Carothers, Lehigh University; Dr. Harold G. Moulton, Brookings Institution president.

Among the automotive men on the committee in charge of the congress and the convention are Alvan Macauley, Packard and AMA president; Lammont duPont, GM chairman, and president, duPont Co.; Max W. Babb, Allis-Chalmers president, and William L. Hoge, president of Mengel Body Co.

British Engineers Spending £8,000 Yearly on Research

The (British) Institution of Automobile Engineers is currently spending £8,000 annually on cooperative research in its own laboratory, according to a correspondent of AUTOMOTIVE INDUSTRIES. Special projects have included work on brakes and squeaks incident to their operation. In 1931 the Institution was spending a matter of £1,500 annually for research, the higher figure being an indication of the British industry's satisfaction with the results.

Ernest A. D. Eldridge

PARIS (by mail)—Ernest A. D. Eldridge, co-designer with Captain Eyston of the automobile "Speed of the Wind," which recently captured 19 world's records on the Bonneville salt flats, Utah, died in London recently from an attack of pneumonia.

Eldridge began his career as a race driver in 1919 and competed at Indianapolis and on other American tracks. After a serious accident at Montlhery, he gave up racing and devoted himself, in partnership with Eyston, to preparing cars for record-breaking performances.

In 1905, Buick production rose to 750 cars, Gus Edwards wrote "In My Merry Oldsmobile," the Cadillac "30" was introduced, Knight invented the sleeve-valve engine, and magneto ignition, ignition locks and roadster and touring bodies appeared.

Taxes on motor vehicle owners in 1934 reached \$1,200,000,000.

Competitive Price Range of the 1936 Coupe, Two-Door, Four-Door Models

Coupe	Pierce - Arrow 1602, 139-in. \$3,695	Four-Door Sedan
Willys-Overland \$395		Willys-Overland \$445
Chevrolet Standard ... 495		Chevrolet Standard ... 575
Ford 510		Ford 580
Plymouth 510		Plymouth 590
Chevrolet Master 560		Chevrolet Master 605
LaFayette 595		Graham 80 665
Terraplane Deluxe ... 595		Terraplane Deluxe ... 670
Pontiac Master 6..... 615		Lafayette 675
Dodge 640		Pontiac Master 720
Terraplane Custom ... 650		Terraplane Custom .. 720
Nash Standard 665		Dodge 735
Oldsmobile 665		Nash Standard 740
Pontiac Deluxe 665		Studebaker Dictator .. 755
Studebaker Dictator .. 665		Nash Deluxe 765
Nash Deluxe 675		Pontiac Deluxe 6..... 770
DeSoto Deluxe 695		Hudson Custom 6..... 785
Hudson Custom 6.... 710		Auburn 654 795
Pontiac Deluxe 8..... 730		Graham 90 795
DeSoto Custom 745		Oldsmobile 795
Chrysler 6 760		DeSoto Deluxe 810
Hudson Deluxe 8..... 760		Pontiac Deluxe 8..... 815
Buick 40 765		Reo 845
Graham 90 765		Hudson Deluxe 8..... 855
Hupmobile Special 6... 795		Hupmobile Special 6.. 855
Oldsmobile 8 810		DeSoto Custom 865
Auburn 654 835		Chrysler 6 875
Hudson Custom 8..... 845		Buick 40 885
Graham Super 110.... 865		Nash Ambassador 885
Hupmobile Custom 6... 870		Graham Super 110.... 895
Chrysler Deluxe 8..... 925		Oldsmobile 8 910
Studebaker Pres. 965		Hupmobile Custom 6.. 930
Packard 120 990		Hudson Custom 8 950
Hupmobile Spec. 8.... 995		Nash Super 8 995
Buick 60 1,035		Hupmobile Special 8.. 1,035
Auburn 852 1,085		Chrysler Deluxe 8.... 1,045
DeSoto Airflow 1,095		Studebaker Pres. 1,045
Hupmobile Custom 8.. 1,125		Packard 120 1,075
LaSalle 1,175		Buick 60 1,090
Auburn 852 Super.... 1,545		Auburn 852 1,095
Cadillac 60 1,645		Chrysler Deluxe 8..... 1,095
Packard 8, 134-in.... 2,470		Studebaker Pres. 1,015
Cadillac V-8, 70..... 2,595		Packard 120 1,040
Packard Super 8, 139-in. 2,880		Buick 60 1,055
Pierce - Arrow 1601, 139-in. 3,195		Hupmobile Custom 8.. 1,095
Cadillac V-12, 80.... 3,295		Auburn 852 1,185
		Lincoln Zephyr 1,220
		Chrysler Airflow 8.... 1,345
		Chrysler Airflow Imp. 1,475
		Auburn 852 Super. ... 1,545
		Buick 90 1,695
		Cadillac 60 1,695
		Cord 1,995
		Packard 8, 122-in.... 2,385
		Cadillac V-8, 70.... 2,445
		Packard 8, 134-in.... 2,585
		Cadillac V-8, 75.... 2,645
		Packard Super 8, 132-in. 2,990
		Cadillac V-12, 80.... 3,145
		Packard Super 8, 139-in. 3,170
		Pierce - Arrow 1601, 139-in. 3,195
		Cadillac V-12, 85.... 3,345
		Pierce - Arrow 1601, 144-in. 3,400
		Pierce - Arrow 1602, 139-in. 3,695
		Packard 12, 139-in.... 3,960
		Cadillac V-16, 90 7,450

The tabulation above shows the price-competition position of each automobile manufacturer on the basis of the three most popular body types. The Austin car has been omitted as, although the company plans to be in production for 1936, prices have not been announced on the new line.

Automotive Industries, November 16, 1935

The Horizons of

The Elections

THE politically detached commuter must have noted with considerable surprise the attitude of his fellow travelers on the morning after Election Day. The train we caught from Greenwich at 8:20 was, we presume, quite typical, its passengers fairly representative of the well-to-do business and professional men who live in the suburbs and go back and forth each day from the great city. Faces were beaming, the greetings of passengers distinctly jovial. The train might accurately have been dubbed the Sunshine Special. The spirit infected downtown offices. The stock market, touched by a mercurial wand, broke into new high levels.

Anticipating a Breathing Spell

In examining this phenomenon we may ignore for the time being the real facts regarding the election. It is not necessary for our purpose to prove that the Administration did or did not suffer defeat. The fact remains that thousands of citizens recruited, significantly, from the more affluent and able strata of society, believed that the election marked a turn in the full tide of Democratic success. These men regarded the results as a rebuke for the principles, the methods and the punitive reforms of the New Deal. Intelligent citizens by the thousand acted like a lot of schoolboys at the end of a tough semester. This carnival spirit, whether we be Democrats or Republicans, New Dealers or Conservatives, provides food for thought. Never

before has this writer noted such a unanimous and exultant reaction to an election among the group which provides the business leadership of the nation.

What is the answer? Is there anything here which will cast a prophetic light upon the more conclusive electoral test in 1936? In expounding the conservative spirit we shall try to speak objectively. We shall describe what we think we see without identifying ourselves with what we describe.

Human Nature

The first thing that impresses us about the conservative is that complex of characteristics which for want of a better term we describe as human nature. The political consequences of this nature are in process of articulation. For the conservative is proving by his utterances, by his votes, by his unmitigated satisfaction over anything which seems to be a New Deal reversal that his memory is short, that he accuses the stings of injury and easily forgets the benefit of favors.

The business man seems to have forgotten the precise and sorry circumstances under which the President was inducted into office. Our banking system had disintegrated, a disintegration which had reached its full cumulative ultimate under a redoubtable Republican Administration. This Administration had every opportunity over a period of 12 years to avoid, insofar as a Government is capable of avoiding, the appalling climax which greeted the new President. It

was a conservative Administration which first failed to balance the budget and transmitted to the new government a lusty deficit. It was during the Administrations of Harding, Coolidge and Hoover, all Republicans, that agriculture progressively declined to its economic nadir. It took a Democratic President to repeal prohibition. During its 12 years in office the opposing party did little to check the growth of bureaucracy. A fair tabulation would reveal an alarming list of ugly scandals and inexcusable mistakes. The conservative forgets all this and thus proves that he is human.

Sound Wood in a Poor Structure

Many of the deeds of the New Deal were founded upon a sincere and sound conviction that they were necessary to the welfare of business. A strong case may be presented for the social security legislation, for the NRA, for the AAA, for the two security acts and for the utility law which a Baltimore judge has just pronounced unconstitutional. The conservative has been so aggravated by the manner in which these reforms were adopted, so incensed by the unnecessary mud slinging which accompanied them and his instincts so alarmed by the vindictive manner in which they were applied that it is difficult for him to take a historical, detached view of New Deal reform and acknowledge the merit which it contains. Perhaps, as one observer facetiously remarked, the New Deal has been administered by the wrong party. Under a Republican administration it may prove more palatable.

of Business

by Joseph Stagg Lawrence

Ample Tolerance for the Politician

Let it not be supposed that the conservative is a creature of caprice, inflexibly faithful to his own prejudices and resentful of the slightest threat to his material interests and what he conceives to be his rights and prerogatives. He could hardly be an American and retain any illusions regarding the sanctity of a vested interest. He could scarcely be exposed for a period of years to his native political atmosphere without acquiring a broad tolerance for a certain amount of insincerity in our statesmen and an easy connivance at party spoilsmanship. He understands the necessity, politically, for a whipping boy or "fall guy."

The honest conservative will admit all this. He may not see it clearly. In his present mood he is not disposed to establish these qualifications of his position. Stated for him as we have here he will say "granted, but this fellow has gone too far."

Over the Line

Therein may be found the reason for the turn in the political tide, assuming that it is an authentic turn which we are witnessing. Business does not expect to be treated gently—in the open—by our politicians. However when an innocuous pursuit of a useful scapegoat becomes persistent and destructive persecution, both fun and utility vanish. Men of wealth are willing to contribute more than their proportionate share of the

cost of government. When the progressive principle of taxation is pressed to a point where equalization of wealth and income is contemplated and such intent is exploited to secure the votes of deluded citizens who can never hope for affluence in any other way, we reach a point where government abandons equity and experience in favor of tyranny through demagoguery.

Consistency is an impractical jewel in politics. Effective political action in a democracy is possible only through continuous compromise. Consistency and compromise are incompati-

ble. To detail the instances which the conservative considers an unpardonable abuse of politically necessary inconsistency would make this seem like a campaign document. We merely attest the widespread conviction that the New Deal is a heterogeneous and constantly shifting conglomeration of fallacious theory, vindictive prejudice and sound principle.

The conservative has been spanked by New Deal publicity and New Deal legislation. He is convinced that the shingle and the woodshed have been used for an ulterior purpose and that the welfare of the victim has been the least of the disciplinarian's objects.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

General business last week continued to show slow but steady improvement despite adverse weather. Retail trade made additional gains, but wholesale lines were somewhat slower. Industrial operations were well maintained. The stock market was more active and quotations were higher. An encouraging development lately has been the appearance of improved third-quarter earnings reports.

Car Loadings Drop

Railway freight loadings during the week ended November 2 amounted to 680,662 cars, which marks a decline of 27,164 cars below those in the preceding week, an increase of 67,614 cars above those a year ago, and a rise of 66,526 cars above those two years ago.

More Power

Production of electricity by the electric light and power industry in the United States during the week ended November 2 was 13.7 per cent above that in the corresponding period last year.

Lumber Production Holds Up

There was a decline in both production and new business at the lumber mills during the week ended October 26. Production was 18 per cent higher than new business and 10 per cent above shipments. It is estimated that lumber production in the country is now from 30 to 35 per

cent above that at the corresponding period last year.

Coffee and Sugar Above Last Year

According to the New York Coffee and Sugar Exchange, consumption of coffee in the United States during the July-October period was 17 per cent above that in the corresponding months last year. The number of bags delivered to consumption channels is higher than that in any other similar period in the half-century record of the Exchange.

Petroleum Firm

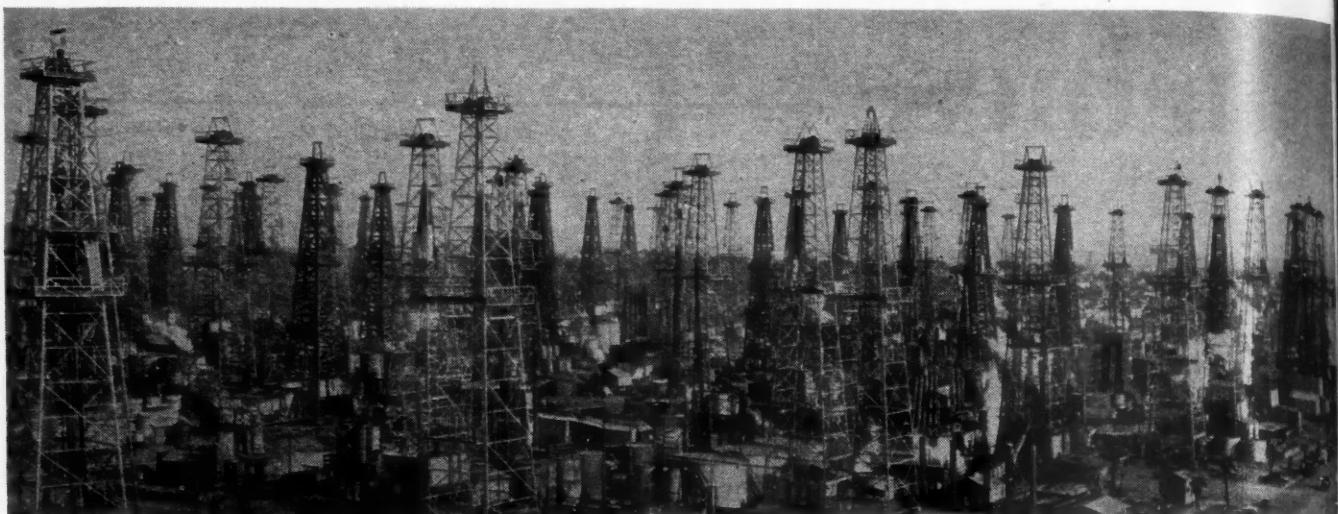
Average daily crude oil production in the United States for the week ended November 2 amounted to 2,798,350 barrels, as against 2,797,950 barrels for the preceding week and 2,285,400 barrels for the corresponding week last year.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended November 9 remained unchanged at 85.0. This figure compares with 85.3 two weeks before.

Federal Reserve Statement

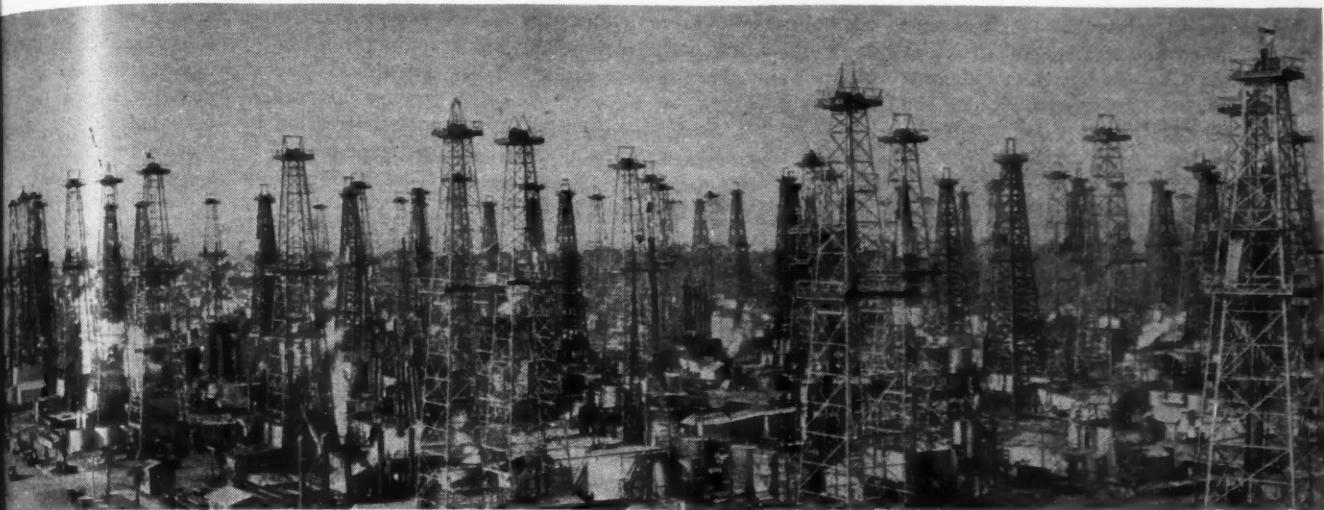
The consolidated statement of the Federal Reserve banks for the week ended November 6 showed an increase in holdings of discounted bills of \$1,000,000. Holdings of government securities and bills purchased in the open market remained unchanged. Monetary gold stocks increased \$28,000,000, and money in circulation rose by \$68,000,000.



Interstate New Fuels

THE interstate oil compact as an instrumentality for eradicating the ills that beset the oil industry was championed at the annual meeting of the American Petroleum Institute, Los Angeles, Nov. 11-14, by E. W. Marland, Governor of Oklahoma and chairman of the Interstate Oil Compact Commission. These compacts aim directly at the elimination of wasteful practices in the production of crude oil and natural gas. They were first suggested in a letter from the Federal Conservation Board to R. C. Holmes, chairman of the Interstate Committee on World Production and Consumption of Petroleum and Its Products of the American Petroleum Institute, dated April 8, 1929.

In 1931 production in the Oklahoma City and east Texas fields got out of bounds, and martial law had to be declared to stop the waste. A little later came the first semblance of an interstate compact when, at the suggestion of the Secretary of the Interior, the Governors of ten of the oil-producing States appointed representatives to act with the Federal Oil Conservation Board as the Oil-States Advisory Committee. This committee met at intervals and, in conjunction with the Federal Oil Conservation Board, supplied to the producing States estimates of the reasonable market demand. Allocations of production were made to the States, and Governor Marland said it was to the credit of the various States that they had remained reasonably within these allocations.



Interstate Oil Compacts are Championed; Fuels and Oils Presented to A.P.I.

The author explained in his paper that the interstate oil compact is a treaty between the States. Every State joining it is bound by its provisions, and contracts to do everything it can to prevent the wasteful production of these natural resources. In joining this compact a State is not impairing its sovereignty, but exercising a power of inherent sovereignty. The compact

leaves every State to exercise its own authority within its own boundary—every State to preserve its own resources by its own laws—and has no extra-territorial authority.

Whether the compact will work depends upon the oil operators of the country, more than any other factor. It also depends upon the Governors, the law-making, the regulatory, and en-

forcing bodies of the several different States. His contention was that it could and must work.

In concluding his paper Governor Marland said that if the oil operators did not meet their problems themselves, stronger hands would attempt their solution. Since the ratification of the interstate oil compact, the compacting States had stayed within the allocation fixed by the best authorities on market demand. Most of the non-campacting States had not. If the compact was to survive, if the industry was to continue to improve, if conservation of these natural resources was to become a reality, then all major oil-producing States must become parties to this agreement, must cooperate in a fixed and definite way, and must not pursue unchartered independent courses.

Of the many papers presented at the



Photo courtesy of the Sun Oil Co.

AT the Annual Meeting of the American Petroleum Institute, held Nov. 11 to 14 in Los Angeles, many papers of direct automotive interest were presented. Watching and listening for Automotive Industries at the meeting was A. Ludlow Clayden, well-known automotive engineer in the petroleum-products field. Supplementing digests of papers, presented on these pages, a news telegram from Mr. Clayden appears in another section of this issue. In a subsequent issue will appear Mr. Clayden's report of the meeting from the standpoint of an eye-witness.

meeting many related to the technique of production and are of no particular interest to the automotive industry. Others related to the products of the

oil industry and particularly to those used in automotive equipment, and abstracts of these papers are given below.

Polymerization-Product Gasoline

THE demand for anti-knock fuel has been so great during the past few years that oil technologists have been searching intensively all possible methods and sources of supply. This study has been accelerated recently by the demand for fuel for high-compression super-charged aviation engines with octane ratings far above anything which has been considered heretofore. Various schemes for cracking heavy oils have been proposed, and thousands of chemicals have been tried with the idea of their use as "dopes" to increase the anti-detonating characteristics of gasoline. Little attention has been directed toward the gases produced as a by-product from cracking operations, a prolific source of valuable anti-knock fuel.

A paper on "The Thermal Process for Polymerizing Olefin-Bearing Gases," by M. B. Cooke, H. R. Swanson, and C. R. Wagner was presented at the meeting. The first two of the authors are connected with Alco Products, Inc., of New York, while Mr. Wagner is connected with the Pure Oil Co. of Chicago.

Polymerization, as is generally known, consists in the union of two or more molecules of a substance to form a larger molecule, the latter being called a "polymer." The olefins of low molecular weight, viz., ethylene, propylene, butylene, etc., form polymerization products when subjected to heat and pressure, no catalyst being required. These polymerization products serve as desirable fuels or blending fuels, owing to their inherent anti-detonating characteristics.

Heretofore attempts to form aromatics from low-molecular-weight hydro-

carbons have been largely confined to pyrolysis of paraffin gases, an endothermic (heat-absorbing) process. Polymerizing olefins is an exothermic (heat-generating) reaction. It is therefore, possible that local points of very high temperature exist at the time of formation of aromatic molecules, but the surrounding gases conduct the heat away rapidly enough to maintain a lower average temperature.

The authors expressed the opinion that the polymerization of olefinic gases for the production of low-sulfur aromatic compounds is destined to increase in importance. High anti-knock-value gasoline, or gasoline-blending material—as well as benzol, toluol, and xylol—can be made with good yields, and at a profit, at the present time. The trend of refinery cracking has been, and still is, from low temperatures (liquid-phase cracking) to higher temperatures with a corresponding decrease in pressures. This tendency has resulted in an ever-increasing gas yield of higher unsaturation. This is ideal for polymerization, as an otherwise wasted (or nearly so) by-product—gas—becomes a valuable charging stock. The refiner can now install a polymeri-

zation plant, and the cost of it can be paid for, in one year or less, out of its earnings. The average refiner can increase his cracked-gasoline output by polymerization by 15-20 per cent if he polymerizes all his cracking-still gases. This material has a very high blending value, and can be made either high in volatility or low in volatility. This flexibility gives the choice of employing high percentages of butane in the blended gasoline; or, if the material available for blending has low volatility, the necessary volatility may be obtained to a large degree from high-volatility polymer gasoline.

The equipment for carrying out the process is similar in appearance, operation, and instrumentation to cracking-still equipment.

The potential yield of polymer gasoline from refinery and natural gas in this country, utilizing the thermal process with efficiencies obtainable at this time, amounts to approximately 110,000,000 bbl. per year, or roughly 25 per cent of the total gasoline consumed in the United States during the year 1934. The octane value is higher than that obtained by any other known thermal or catalytic process for producing gasoline. Only tetraethyl lead may be considered a competitor for enhancing the anti-knock value of gasoline—and this material does not increase the amount of gasoline to be used as fuel, but only alters and improves the anti-knock quality.

Fig. 1 gives the distillation characteristics of typical polymer gasolines produced by various methods.

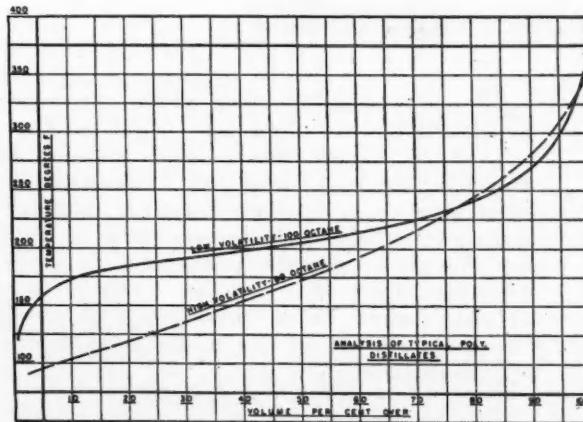
Fuels for High-Speed Diesel Engines

A PAPER on the high-speed Diesel-engine-fuels situation as viewed by the petroleum refiner was presented by William Mendius, W. Ainslee and C. H. Schlesman, the first two being connected with the Sinclair Refining Co., and Mr. Schlesman with the So-

cony-Vacuum Oil Co., Inc. According to these authors it has been fairly well proved that practically all high-speed Diesels can be satisfactorily operated with a market supply of two grades, one a light and the other a somewhat heavier distillate, the choice between the two being left to the consumer to a certain extent.

The present supply of burner fuels offers a logical source for the present Diesel fuel market. Of course, some of these burner fuels, though excellent for their intended purpose, possess too low cetene ratings for practical use, and these would be automatically excluded from the Diesel-fuel market. Straight-run basic Diesel fuels, with the exception of those derived from Gulf Coastal crudes, have cetene ratings of 55 to 65, with pour points ranging from -10 deg. F. to 40 deg. F. As a rule an increase in the cetene rating is accompanied by an increase in the pour point. Specifications of a variety

Fig. 1—Distillation characteristics of typical polymer gasolines



of basic straight-run Diesel fuels were given in the paper; these fuels had viscosities of from 33 to 39.

The cracked fuels also, except those from Gulf Coastal and some California crudes, have cetene ratings ranging from 35 to 55, pour points of 0 deg. F., or less, and viscosities from 32 to 34.

While engine builders, and probably some major consumers, are familiar with the fact that fuels of high cetene rating must command a higher price than fuels of low cetene rating, they may not be as well aware of the influence of other factors upon fuel cost. Too high a cetene requirement will eliminate the greater portion of cracked Diesel fuels. Virgin oils must supply the demand.

The use of solely virgin oils introduces the pour problem for many crudes. Dewaxing operations are expensive. Year-round Diesel-fuel specifications which demand 0 pour point are fairly common. Since the pour point of a fuel is of little importance during the summer months, the demand for 0 pour point during warm weather results in an economic waste. A dewaxing charge may be avoided by including in the specifications separate pour limitations for winter and summer usage, preferably influenced by climatic conditions in the zone of consumption.

Virgin oils routed to Diesel consumption must also compete with the value of this stock as a source of high-anti-knock cracked gasoline. Prices of the respective fuels determine the economic balance.

Material narrowing of the boiling-point specifications would, by virtue of decrease in yield and added refinery-distillation processing, add to the refinery costs.

It is estimated that refinery costs alone may be increased by as much as 1 cent per gallon by imposing Diesel-fuel restrictions similar to those noted above.

The petroleum industry has established substantially nationwide distribution for two classes of fuel products, viz., motor gasoline and burner fuels. As Diesel fuel is not being marketed in any appreciable quantity for passenger or light-truck use, the use of the service-station outlet is impractical. The present demands as bulk sales, in small or large volume, make it necessary for the refiner either to market Diesel fuel through its present burner-oil system or to set up an entirely new distribution system.

At the present time the industry has invested many thousands of dollars in property and equipment, which is employed in the distribution of burner fuels. This system handled upward

of 35,000,000 bbl. annually, the bulk of the demand being confined to two grades. In view of the huge investment, it is obvious that the necessity of financing a similar system for Diesel fuels, although of much smaller proportion, would so retard the widespread distribution of such fuels as to serve as a deterrent to the adoption of this

class of engine in all but the largest cities.

Even if the industry were able and willing to finance such an undertaking, it is evident that the investment, carrying and operating charges would, of necessity, be passed on to the consumer as part of the price of Diesel fuel.

Diesel-Trucking Costs

A CAREFUL analysis of costs of transportation with gasoline-engined and Diesel-engined trucks was presented by C. G. Anthony of the Pacific Freight Lines, Los Angeles, Cal. The analysis was based on cost data from ten Diesel-engined and ten gasoline-engined trucks, all trucks being of the same make and capacity. Each of the 20 trucks at all times pulled a six-wheel trailer, and under loaded conditions the total gross weight of truck and trailer was 68,000 lb. All trucks and trailers were operated with an average gross-weight load factor of 70 per cent.

Some of the items of operating costs were the same for both classes of vehicle and were disregarded in the analysis, which took into account the costs of fuels, lubricants, maintenance, depreciation, interest on investment, and fire and theft insurance.

The Diesel truck weighed 16,245 lb. empty, the trailer, 15,500 lb. empty, and the legal gross weight of truck and trailer was 68,000 lb. During the first four months of 1934 the following average results were obtained with the ten Diesel trucks:

Average cost of fuel per gallon	\$0.0351
Average cost of oil per gallon	\$0.4653
Average miles per truck per month	6,712
Average miles per truck per day	224
Miles per gallon of fuel.....	6.10
Miles per gallon of oil.....	144.4
Fuel cost per mile.....	\$0.00575
Oil cost per mile.....	\$0.00322
Repair cost per mile.....	\$0.02097
 Total cost per mile.....	 \$0.02994

The same study was made for the identical equipment for the first four months of 1935, and the average results were as follows:

Average cost of fuel per gallon	\$0.0416
Average cost of oil per gallon	\$0.4583
Average miles per truck per month	6,193

Average miles per truck per day	208
Miles per gallon of fuel.....	5.93
Miles per gallon of oil.....	143.8
Fuel cost per mile.....	\$0.00702
Oil cost per mile.....	\$0.00319
Repair cost per mile.....	\$0.02200
 Total cost per mile.....	 \$0.03221

Costs with the ten gasoline-engined units during the first four months of 1934 averaged as follows:

Average cost of fuel per gallon	\$0.1216
Average cost of oil per gallon	\$0.4727
Average miles per truck per month	4,613
Average miles per truck per day	153
Miles per gallon of fuel.....	3.70
Miles per gallon of oil.....	160.5
Fuel cost per mile.....	\$0.03947
Oil cost per mile.....	\$0.00294
Repair cost per mile.....	\$0.01689
 Total cost per mile.....	 \$0.05930

The combined costs of gasoline-truck operation was found to have been \$0.09057 per mile and the combined costs of Diesel-truck operation, \$0.06530 per mile, giving a difference in favor of Diesel operation of \$0.02527 per mile. The fuel cost per truck mile was 83.58 per cent less in the case of the Diesel trucks. The cost of repairs, on the other hand, was 27.11 per cent greater. This, the author observes, is about the same relative figure for repair costs which has been obtained in Europe. Oil costs are 0.91 per cent higher in the case of the Diesel trucks; depreciation, 9.63 per cent higher, interest, 8.19 per cent, and fire and theft insurance, 9.83 per cent higher. Adding up the various cost items considered it is found that the operating cost of the Diesel trucks was 27.91 per cent lower.

Under present conditions of distribution, Pacific Freight Lines has found it necessary to centrifuge all Diesel fuel before putting it into the truck tanks. Such materials as tank scale, dust,

asphaltic particles, etc., must be removed before going to the engine fuel system, because otherwise clogging of the filters occurs and causes damage to the finely fitted parts such as the fuel pumps, injection nozzles, etc. This prob-

lem of maintenance of clean fuel is being studied by the oil companies; the higher viscosity of the Diesel fuel makes clarification somewhat more difficult, but no doubt the problem can be solved.

E. P. Engine Lubricants

IN a paper entitled "Improved Lubricants and Lubrication," L. L. Davis, Bert H. Lincoln and B. E. Sibley of the Continental Oil Co., an account was given of tests with various addition agents to lubricating oil designed to improve its lubricating value. Tests were made with both the Almen and the Timken testing machines.

The increased severity of the operating loads, speeds, and temperatures of the modern automotive engine have necessitated the improvement of crankcase oils. The true lubricating value or the ability to lubricate under severe or abnormal conditions may be improved by the use of carefully-selected addition agents. The selection of such an agent cannot be accomplished with a single or limited group of laboratory tests, but must ultimately depend upon actual service tests on the road. A detailed study in the laboratory of all of the factors involved in lubrication is a valuable preliminary step.

Among the factors which must be investigated in order to be able to judge the value of an addition agent are the following:

Load-carrying capacity (the highest load that can be carried at the highest probable temperature with a minimum supply of oil for an indefinite period); oiliness (the ability of an oil to operate under the boundary or thin film conditions with low friction and resultant low heat formation); rate of wear of bearing surfaces, corrosive effects and protection afforded metallic surfaces against corrosion; stability at high temperatures, volatility, flash point, pour point, solubility and toxicity.

For purposes of comparison the various addition agents tested were used in a 1 per cent solution of a standard

S.A.E. 30 oil. For the sake of brevity the term "chlor-ester" is used to designate methyl- α α -dichlorostearate. In blends the regular commercial content of 0.75 per cent of the chlor-ester as used in Conoco Germ-Processed motor oil is understood.

The Timken film strength is defined as the load in pounds on the beam at 788 r.p.m. and 100 deg. F. for 10 minutes which results in incipient scarring of the bearing surfaces. To obtain reproducible results it was found necessary to use an automatic loading device. A standard rate of 22.8 lb. per min. is used in all Timken film-strength and wear tests. With this rate of loading seizure occurred at 13 lb. load with the mineral oil and at 25 lb. load with the chlor-ester blend. The relationship between viscosity and film strength was also determined by the Timken

machine. As the viscosity increases, so does the film strength, and the film strength of the chlor-ester blend is shown to be much greater than that of plain mineral oil throughout the range of viscosities. For instance, at a Saybolt viscosity of 2000 sec. at 100 deg. F., the Timken film strength was 10 lb. for the plain mineral oil and 25 lb. for the chlor-ester blend.

The Timken film strength is not a measure of the rate of wear or corrosion, and therefore is not an indication of what might be termed the "useful load-carrying capacity." However, long-time tests on the Timken machine indicate that the high rate of wear or "lapping-in" takes place in the early stages of the test, and that if a lubricant will carry a given load for 90 minutes it will carry that load for an indefinite period without excessive wear. Therefore, to determine load-carrying capacities, a series of 90-minute runs was made on the Timken machine with progressively increasing loads, until the oil failed to carry the load for 90 minutes. The number of minutes the last load was carried before failure was recorded. Table 1 shows the results obtained from 1 per cent solutions of various addition agents in an S.A.E. 30 mineral oil.

Aviation Fuel Ratings

A REPORT of the Cooperative Fuel Research Committee on Rating Aviation Fuels in Full-Scale Aircraft Engines was made by C. B. Veal, secretary of the Committee. Mr. Veal gave an outline of the work of the Committee. The program provided for the investigation of three series of fuels:

(a) Those whose knock characteristics are essentially unchanged under varying test conditions.

(b) Those whose knock rating decreases sharply with increasing severity of test conditions.

(c) Those whose knock rating improves with increasing severity of test conditions.

The tests made showed satisfactory correlation (up to 87 octane number) between "motor method" laboratory ratings for fuels "a" and "a" plus lead and "b" and "b" plus lead, but indicated that in this range fuels "a" plus benzol and "c" plus lead are somewhat over-rated by the present laboratory test, and that the performance of a particular benzol blend may vary within rather wide limits—depending on engine design and operating conditions. It was stated in the report that in view of these results and the need of considering fuels in the range above 87 octane number, no attempt would be made to secure improved correlation by modifying the "motor method" until further experimental data are available.

The data of the tests conducted, which are given in the paper in the forms of tables and graphs, led to the following general conclusions for the range of octane numbers and the specific types of fuels included in the tests:

The "a+lead" fuels are correctly evaluated by the motor method. This would be expected, since the motor method is evaluated in terms of the agreement between the reference fuels and the test fuels—and in this case

Table 1—Relation Between Timken Film-Strength and Load-Carrying Capacity

Addition Agent—1 Per Cent Added to Mineral Oil	Timken Film Strength (Pounds)	Load-Carrying Capacity		
		No Seizure (Pounds)	Seizure (Pounds)	(Minutes)
SAE-30 mineral oil	8.8	10	15	1
Methyldichlorostearate	28	20	30	6
Trichlororesorcinol	125	20	30	46
Dichlorostearic acid	59	30	40	6
Dichloropropylether	44	15	20	30
Pentachloroethane	38	20	30	12
p-Chloroaniline	38	15	20	2
p-Chloroanisole	25.5	10	15	2
Chloropseudocumene	15.5	10	15	5
Hexyl chloride	8.8	10	15	2
Oleic acid	8.8	10	15	1

they are of substantially similar type.

In the higher octane-number brackets the "a+benzol" fuels are over-rated by the motor method, as shown by their behavior in some aircraft engines. Fuels containing large fractions of benzol were found to be erratic, and subject to wide variations in behavior with changes in engine type and operating conditions. Although benzol is the only aromatic fuel included in the work, it would appear that where fuels of more than 80 motor-method octane number are concerned, the motor-method rating should be regarded with

caution and verified by service-test data for any particular engine and installation if the total aromatic content exceeds 40 per cent by volume.

Fuels of the "b" series are sensibly correctly rated by the motor method. This conclusion is subject to confirmation if fuels of this type (i.e., of high acid heat) of higher octane number than those tested should later become available.

The motor method over-rates the gasoline blends of the "c" series by approximately two octane numbers at 73, and approximately one octane number

at 87. Whether this result is related to volatility or to the composition of the particular fuel used in these tests is not known. This point might be worth investigating later by tests of very volatile fuels of other types.

The full-scale engine-test procedure, set up to test fuels rather than engines, has produced satisfactory results. The method used does not altogether simulate the conditions by which fuels are judged in service, but for the most part is closely related thereto. It provides a degree of accuracy which cannot be attained in flight testing.



AUTOMOTIVE ABSTRACTS

Detonation in Diesel Engines

In the course of an experimental investigation of injection in Diesel engines, with which he was entrusted by the Engineering Department of the French Air Corps, M. René Retel studied the operation of the Diesel engine by means of a Serruys high-speed indicator. In the diagrams given by this indicator, detonation is indicated by an extremely rapid rise of the pressure line, quite distinct from the pressure rise due to normal combustion. Measurement of the amplitude of the displacement of the "spot" makes it possible to gauge the intensity of the detonation, but does not give an absolute measure of the phenomenon. It is reasonable, in fact, to assume that detonation is a local phenomenon and that the explosive wave which it produces is damped out in part in the course of its passage through the combustion chamber; consequently, the impulse imparted to the pressure element of the indicator depends upon its distance from the center of detonation. Since this distance is unknown, the rise in pressure indicated by the diagram is merely a qualitative indication of the force of the detonation and of the pressure wave to which it gives rise.

The results of the investigation are summarized as follows:

1. The intensity of the detonation is independent of the load and speed of the engine.

2. Detonation nearly always takes place at the beginning of the combustion period, and rarely after the combustion has been partly completed; it therefore does not seem to result from an acceleration of the combustion but rather presents the characteristics of a spontaneous explosion.

3. In the engine on which the investigation was made, detonation occurred only when injection took place considerably ahead of the dead center. There was never any detonation when the injection was retarded.

The author concludes that in order to eliminate detonation in a Diesel engine, fuel injection must be made to occur later, and that to maintain the efficiency of combustion in spite of the later injection, the ignition lag must be reduced. This can be accomplished by increasing the fineness of atomization, and an increase in the compression ratio within certain limits is also of advantage in this connection.—*Le Génie Civil*, Aug. 24.

New Hillman Minx Four-Cylinder Model

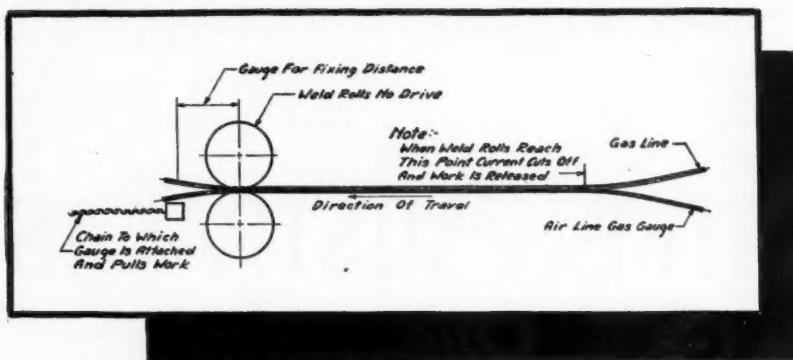
A NEW Hillman Minx four-cylinder model just announced in England has a frame which is composed entirely of box-section members. Each frame member is made of two pressings which are united by welding. The side members consist of channel sections with the open side turned outward and part of the lower flange turned down to form a lip. Against this is welded a plate having its top edge turned over to form a lip, and the lips are then welded to the adjacent portions of the other member. The cross members consist of channel pressings with the open side down and with the edges of both flanges turned over to form lips, and plates are then welded to the bottoms of these members. This applies to the intermediate cross members. The front cross member is made up of two channels fitted one inside the other and then welded together. It is claimed that this construction gives great torsional rigidity. The steering gear is located at the extreme front end of the frame and the drag link extends back from the steering arm to the arm on the right-hand steering knuckle. The arm of the steering gear, usually referred to as a drop arm, in this case extends upward. The engine is placed over the front axle, which permits of fitting a four-seater body on a chassis of only 92-in. wheelbase. Engine displacement is 72 cu. in., the car weighs 2170 lb., and the price is £159 for the standard model and £175 for the deLuxe model, which differs from the standard in having additional equipment.—*The Motor*, Sept. 3.

Trolley Buses for London

It has been decided by the London Passenger Transport Board to replace trolley cars (trams) by trolley buses over some 90 miles of route, which is equivalent to one-quarter of the routes now served by trolley cars. Orders for 252 trolley buses have been placed with the Associated Equipment Co., and while their design follows closely that of an experimental unit placed in service about a year ago, a number of improvements have been made. They include the provision of two batteries which when connected in series can be used to run the vehicle into side streets if the overhead supply fails. The same equipment can also be used for

(Turn to page 668 please)

New Seam Welder Produces Thirty Feet Tubing per Minute—Made by



Grooved welding wheels rotate freely on shafts as fixture pulls tube through welding unit

THREE interesting applications of resistance welding are described in the October issue of "Flashes," a publication of the Thomson-Gibb Electric Welding Co.

The first machine is used to weld a double copper plated steel tube which is part of the fuel feed system of a well known automobile. Welding the tubes in this way makes them easier to install and keeps them from rattling or chafing in position.

The machine, Fig. 1, consists of a pair of grooved welding wheels which rotate freely on their shafts and a fixture which pulls the tubes through the welding unit. Tubes are cut to length in advance and are held in a gauge which starts the weld a fixed distance from the ends to allow slack for connecting. To make the weld, the operator simply steps on a treadle which starts the cycle. When the correct length of weld is made,

the current cuts off automatically and the machine returns to position ready for the next weld. It is of interest to note that this machine has no driving mechanism for the welding wheels and no current interrupting device. The tubes are pulled through the wheels by the fixture and the current remains on continuously from start to finish.

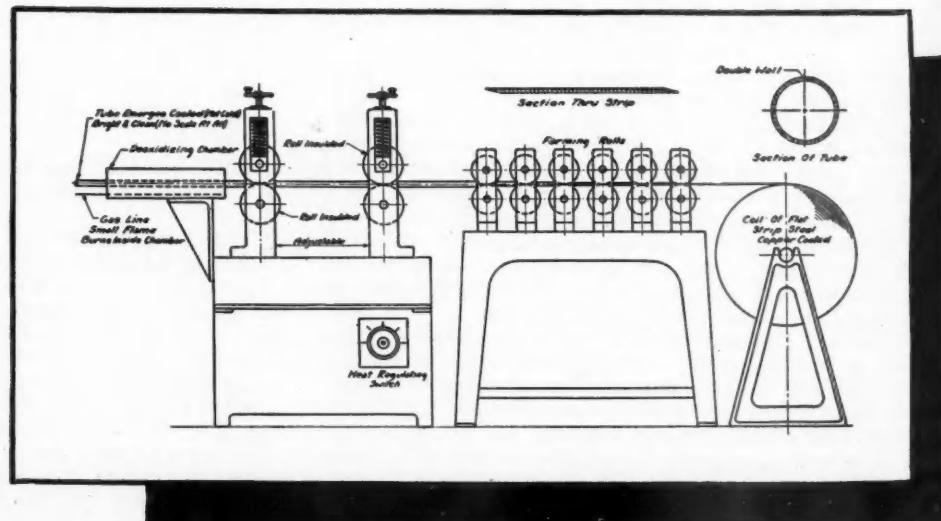
The other application, Fig. 2, is even more unusual because the welding transformer serves as a heating unit. The product is small copper-plated steel tube. The heating unit is linked with a forming machine which shapes the tube from flat strip steel.

The heating unit consists of two

pairs of grooved wheels—one of each pair is insulated from its mounting; the other two are connected at the secondary terminals of the transformer. The wheels are arranged so that the distance between each pair can be altered to suit operating conditions. This arrangement, together with a current regulating switch, provides an infinite variety of adjustments to take care of changes in speed of the machine or size of the tubing.

As the tube leaves the forming machine it is pushed on through the heating unit by feeding rolls where the copper coating is melted and the steel fused into a tight joint. It was found that when the tube cooled in the open air, oxidation turned the outer surface almost black. By delivering it into a cooling chamber made of a length of ordinary merchant pipe heated by a small gas flame, the brazed tube emerges quite cool and bright. It is said that $\frac{3}{8}$ " tube can be made in this equipment at the rate of 30 ft. per minute.

Guiding the seam of a gas tank through the wheels of a seam welder is no simple task but the special triple hinged, ball bearing mounted work table shown in Fig. 3, fitted to a Thomson-Gibb Model 1020 circular seam welder, provides a way to handle such work. It supports the work in the



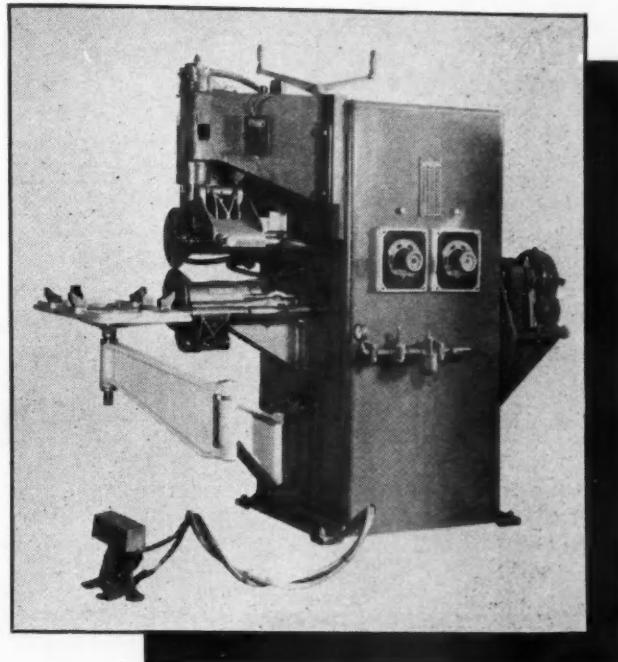
Heating unit linked with forming machine shapes tubes from flat strip steel and prevents rapid cooling

Sheet of Fuel Feed by Thomson-Gibb

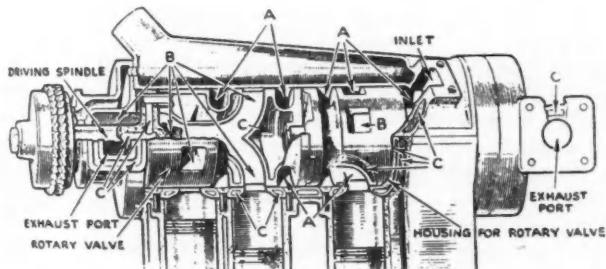
correct position for welding and at the same time, leaves it completely free to turn the sharpest curves or angles.

The unit is made to precise limits to reduce friction to a minimum and to keep the table perfectly level in any position. Both the table and arms are of aluminum. They are light, free from magnetic attraction, and can be adjusted to take care of wear on the welding rolls. The hardened steel locating blocks cradle the work securely and eliminate any chance of slipping.

Thomson - Gibb
circular seam
welder reduces
friction; keeps
table level in any
position



Test Cross Rotary-Valve Engine



Rotary - valve
engine used by
Morris Minor in
four-cylinder car
engine

IN England, the same as in this country, there has been a rerudescence of activity in the development of rotary valve engines. According to a news item recently published in the London *Morning Post*, no less than fifteen car manufacturers in Great Britain, France and other European countries are at present testing out the Cross rotary valve engine, the invention of R. C. Cross of Odd Down, Bath. This valve so far has been used mainly for motorcycle engines, and there also only experimentally we believe. Three years ago the Cross valve was applied to a Morris Minor four-cylinder car engine, and this application is shown by the accompanying pen-and-ink drawing (reproduced from *The Aeroplane*). What is described as a very effective

seal has been evolved for the valve by allowing the edges of the port in the cylinder-head bush to be in resilient contact with the valve face. A circulatory system of lubrication is used for the valve. Oil is pumped onto the valve face on one side and is scraped off again on the opposite side. This results in a certain oil cooling for the valve. Nitri cast iron has been found excellent material for the valve when working against a Carobronze bushing.

Most of the experimental work has been done on air-cooled single-cylinder engines. Valve and valve-bushing are made hollow and oil is passed through them quite rapidly to increase the cooling action. Jets of oil are also directed against the under side of the piston, with the net result that, except for the

spark-plug points, the combustion chamber is completely devoid of hot spots and has a low mean temperature.

The low combustion-chamber temperature permits of the use of low-grade fuels, such as those of 65 octane number, which can be readily obtained all over the world and also sell at lower prices than special aviation gasoline. In addition, exceptionally high compression ratios can be used, and Mr. Cross relates that with small cylinders of 15 cu. in. displacement he has successfully used fuels of 65 octane number with a compression ratio of 11 to 1, which gave a b.m.e.p. of 150 lb. per sq. in. at 4,600 r.p.m. and 133.5 lb. per sq. in. at 6,000 r.p.m. This latter figure represents 1 hp. per cu. in. displacement.

Diesels for the Zeppelin

The new Zeppelin LZ 129, which has now been completed, is equipped with four Mercedes-Benz 12-cylinder V pre-combustion - chamber - type Diesel engines of 800 hp. each and in addition with two 50 hp. Diesel engines of the same make for generator drive. It is understood that several firms developed Diesel engines for the ship and that the contract eventually was awarded to the Daimler-Benz firm after extensive tests covering fuel economy, freedom from critical speeds, and reliability.

Factors Influencing Spiral-Bevel Gear

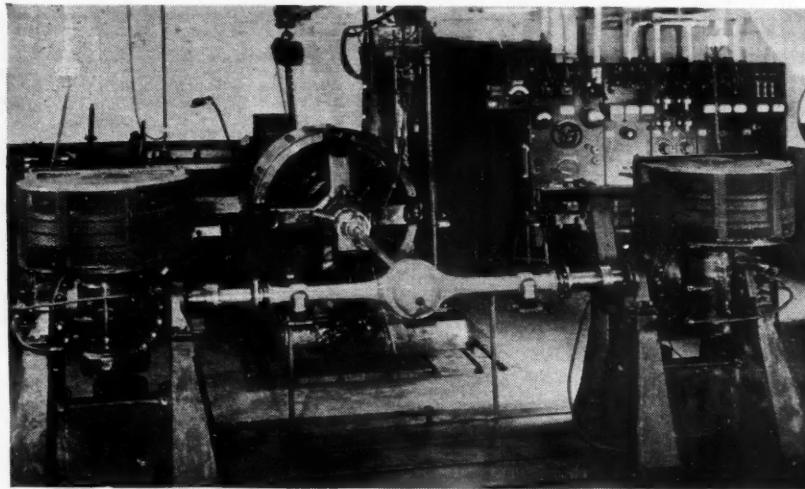


Fig. 1—Special type of rear axle equipment used by G-M Research Division in durability tests.

THE cause of failure of gears in service varies with the type of gears and with the service they perform but, in general, failure is due to tooth breakage, to the destruction of the tooth surfaces by wear of several kinds, and to pitting. For the past eight years, General Motors Research Division has made an organized effort to determine the causes of failure in automobile gears and to find practical remedies. In the course of this investigation, laboratory breakdown tests have been run on some four hundred automobile and truck rear axles, and thousands of service records have been examined for the purpose of correlating the laboratory tests and the performance of the gears in normal service. This study has led to some definite conclusions, particularly for spiral-bevel rear-axle gears, but it is probable that many of the factors that influence the service life of such gears will apply also to gear sets in general.

It has been found that gear-tooth breakage in service is due to fatigue, and that this fact provides data for more accurate tooth stress calculation than has been possible heretofore. Destruction of rear-axle gear-tooth surfaces by scoring is due to welding of small areas of the mating teeth under

the influence of high pressure and high temperature. Pitting results from fatigue of the tooth surface due to repeated high compressive stresses, and is of the same nature as is encountered in ball and roller bearings.

Of the alloy steels and heat treatments that have been used for carburized automobile rear-axle gears, one cannot be shown to be superior to another, except for warping tendencies and consequent variation in stress concentration.

The potential load-carrying capacity of automobile gear teeth is not realized, due to stress concentrations resulting from deflection of the gears and their supports, unequal tooth spacing, eccentric and wobble mounting, etc.

Axle-Testing Equipment

The specialized type of rear axle-testing equipment used by General Motors Research Division is shown in Fig. 1. The propeller shaft of the rear axle undergoing test is coupled to a large direct-current, cradled dynamometer capable of 1570 lb.-ft. torque. The axle shafts of the rear axle are connected to two cradle-mounted alternating-current power-absorption units through a 13.66 to 1 speed increasing gear. This speed-increasing gear is made from a com-

mercial worm-gear truck axle in which the worm wheel is used as the driving member and the worm as the driven member. A ten-pole alternator is mounted directly on each of the worm shafts. During tests, the alternators are usually run at 720 r.p.m., which results in synchronism with the alternating-current supply to which they are connected. This not only provides simple speed control means, but has the further advantage of reducing the current consumption through regeneration.

The load applied to the axle gear during the test is usually equal to maximum torque of the engine multiplied by the transmission low-gear ratio, that is, approximately three times maximum engine torque. The test at this load is continued until failure occurs, which, in practically all cases, is by breakage of one or more pinion teeth. Records are kept of the propeller-shaft load, axle-shaft loads, oil temperature and the number of revolutions of the propeller shaft during the test. It is customary to run at least three axles of each design. The average duration of these runs is considered a measure of the relative merit of the axle for direct comparison purposes. As a fatigue value, it is, of course, always better to use an average of several tests than to rely upon a single specimen. In the accompanying charts, each plotted point is, therefore, in most cases, an average of results from three or more axles.

It is not generally realized that no form of test short of operation in actual service will produce reliable data. When all the test conditions are made to faithfully reproduce actual service conditions for the rear axle, it will be found that not only must complete vehicles be used, but they must include driving the vehicle under all conditions of roads and loads, including the type of driving that is usually considered abusive, such as driving through deep mud or sand, carrying large overloads, etc. It will not suffice that the test be conducted by a test driver, since the proper proportions in various types of service will only be found through

in the Durability of Gear for Automobiles

By J. O. Almen,

Head, Dynamics Section, Research Division, General Motors Corp.

records of owner-driven cars. These data must be accumulated in the same manner as mortality tables are accumulated for the calculation of insurance rates, with the difference that the automobile designer does not have the privilege of eliminating the poor risks, that is, the abusive driver.

Efforts to draw conclusions from arbitrary laboratory tests all too frequently lead to misconceptions of design and material requirements that persist for long periods. An example is found in the long-held belief that axle-gear failure in service was due to shock loading, with the consequence that tests and material specifications were drawn to meet conditions that did not exist in service, as will be discussed.

Same years ago, Buckingham[†] suggested the general theory that gears in some types of high-speed service are subjected to high impact loads due to oscillation of the gears, and that gear-fatigue failure is often due to the overstress resulting from such shock loads, rather than to the normal driving loads.

Elastic Characteristics

To determine whether such impact loads were contributing to automobile rear-axle failures, measurements were made of the elastic characteristics of the rear-axle structure, from the front end of the propeller shaft to the road tires. It was found that the elasticity in this driving train, relative to the moment of inertia of the gears, is such as to make impact loading of the type described by Buckingham practically impossible in automobile rear-axle gears. Furthermore, the bulk of rear-axle gear failures in service were found to originate in a few isolated sections of the country during the spring and fall seasons. Their geographical distribution and seasonal character indicated hard pulling rather than fast driving as the reason for failure. However, as a further check for impact loading, road tests were conducted with telephone receivers coupled across the gear teeth, which showed continuous closed circuit under all driving condi-

Seven or eight years of exhaustive research are condensed by Mr. Almen into this important paper,* the greater part of which has not appeared previously in any form. Because of its length it is necessary to publish it in two parts. Part 2 will appear in the next issue of AUTOMOTIVE INDUSTRIES.

tions, except when the torque was reversed.

In the beginning, the tests herein reported were conducted for the General Motors car divisions merely as routine durability (or breakdown) tests, without any detailed consideration as to the manner of gear-tooth failure or to the factors influencing this failure. The main purpose of the test was to establish the durability of a new design relative to a past design on which service experience data had been compiled. Initially, then, the procedure was simply a matter of orderly recording and study of test data. As the tests progressed, however, it became apparent that many popular conceptions of materials and design did not agree with test results. The formula in general use for calculating bending stress in gear teeth was found unreliable. No consistent difference could be found among the various steels and heat treatments used in production. As later analyzed, variations in stress concentration due to deflections, tooth forms, machining scratches, etc., had so great an effect on fatigue resistance as to obscure the effects of various alloys and heat treatments. Laboratory tests on standard specimens were not in quantitative, and few in qualitative, agreement with these tests on gears.

It must be emphasized that, at the time this type of breakdown-test equipment was first put into operation, it was not generally recognized that normal pinion-tooth failures in service were due to fatigue. Therefore, before

the results obtained by this laboratory fatigue test would be admissible, it was necessary to establish that this test rated gear assemblies in the same order as these gear assemblies were rated in actual owner service. Furthermore, even if normal service failure was found to be due to fatigue, as was indicated by examples of failures showing typical fatigue fracture, it would still be necessary to find out how a laboratory fatigue test should be conducted to rate the gears in their proper order. That is, should the gears be run at relatively low loads and high speeds, or should they be tested at high loads and low speeds? This question could be answered only by searching the service records for examples of production axles that were representative of several degrees of durability. The type of information sought for was found after reviewing thousands of service reports; that is, records were found showing relatively larger and smaller numbers of service failures for several production designs. With this information as a guide, it was found that axles tested under maximum low-gear torque on the axle-testing equipment, showed the same relative resistance to failure that was shown by the service records.

From these checks, it was believed reasonable to conclude that, when a

* Presented at the eighteenth annual meeting of the American Gear Manufacturers Association, Niagara Falls, Canada, Oct. 14-15 1935.

† Buckingham, "Dynamic Loads on Gear Teeth," Research Publication, Am. Soc. Mechanical Engrs. (1931).

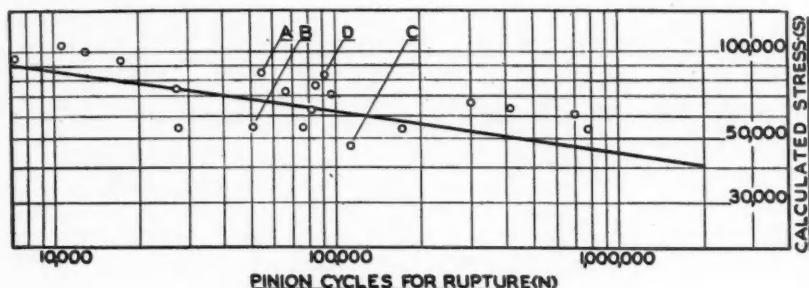


Fig. 2—Spiral bevel gear fatigue curve calculated by "Lewis" formula.

rear-axle gear fails in service, the failure is due to fatigue of the gear tooth as a result of intermittent loading; and that the fatigue life of a gear tooth is used up in the accumulative effects of short periods of operation under maximum low-gear torque.

From the comparison of the laboratory tests with service records, it was found that operation for 100,000 pinion cycles under maximum low-gear torque on the test equipment was equivalent to a lifetime of service in the automobile under the most severe operating conditions. The requirements for truck and bus axles are somewhat higher, owing to greater average severity of service.

In commercial gears and many other machine elements, such as connecting rods, valve springs, crankshafts, etc., the number of maximum stress cycles occurring during the life of the machine is such a large proportion of total cycles that the permissible stress at the fatigue limit is the important value to be used in design. Many automobile parts, such as rear axle gears, axle shafts, transmission gears, etc., differ from ordinary machine elements in that the number of maximum stress cycles is such a small proportion of the total cycles that they may be designed to operate under maximum loading at stresses far above the permissible stress at the endurance limit. As he has been stated, the minimum required life of a rear-axle pinion at maximum stress is only 100,000 cycles, equivalent to about 30 miles of road travel. The tooth stress in normal car operation, that is, in high gear, is so low as to be negligible from a fatigue standpoint.

Several cases are known of service failures of rear axle gears in automobiles in actual owner service, the entire history of which were known. On the average, the total number of pinion cycles of operation in the car was 1000 times the number of cycles run in the laboratory test. In other words, the severity of service in the hands of the hard driver is approximately one one-thousandth as great as the service in our laboratory test. With due qualifi-

cation, it might be roughly stated that, in the car, there is only one maximum stress cycle per thousand total cycles.

Need for Modified Stress Formula

From the beginning, the values obtained from these rear-axle-breakdown tests were plotted in the usual manner for fatigue specimens, as shown in Fig. 2. In this log-log plot, the calculated stress of the specimen is shown on the vertical scale and the number of stress cycles before failure occurs is shown on the horizontal scale. Data points plotted in this manner should have lain reasonably close to a straight line, if gear-tooth failure were really due to fatigue. However, the plotting of the first 20 points, corresponding to 62 individual axles broken in test, resulted in wide scattering of the points, as shown in the figure. This scattering was most disconcerting, since it indicated that gear failures were too erratic to permit their study as fatigue specimens, unless some rational explanation for the scattering could be found. Among the reasons that might be accountable for the unusual scattering was possible errors in the method by which gear tooth stresses were calculated. The method that had been used was the gear-tooth-stress formula originally introduced by Dr. Wilfred Lewis some forty years ago.

A modification of the Lewis formula had been suggested by McMullen and Durkan in "Machinery," June, 1922, but the new formula did not come into

general use. When the tooth stress of the same 62 axle gears was recalculated by McMullen and Durkan modification, they plotted to the curve shown in Fig. 3. Here we find little evidence of the disorder that characterized the original plot. The points lie as close to a straight line as could be expected from highly accurate laboratory fatigue specimens, notwithstanding the fact that these test points represent ordinary production axles of many sizes and designs. It is a striking proof of the greater accuracy of the modified gear tooth-stress formula. Note that the gears represented by points A and B failed after approximately the same number of stress cycles, indicating that they were actually stressed alike. In Fig. 2, the gears represented by point A were calculated by the Lewis formula to be stressed 85,000 lb. per sq. in., whereas the gears represented by point B were stressed, according to the Lewis formula, to 55,000 lb. per sq. in. When calculated by the modified formula, these gears were found to be stressed alike, that is, approximately 47,000 lb. per sq. in. Or, comparing points D and C, Fig. 2, calculated by the Lewis formula, point D was stressed to 85,000 lb. per sq. in. and point C stressed to 47,000 lb. By the modified formula and as plotted in Fig. 3, the stress was calculated at 43,000 lb. per sq. in. for point D and 41,000 lb. per sq. in. for point C. Thus, the Lewis method of calculating stress may introduce inaccuracies on the order of 80 per cent, whereas the McMullen and Durkan method reduces these inaccuracies to negligible amounts.

In comparing Figs. 2 and 3, it will be noted that the stress scales in the two plots are quite different. No means are yet available for determining the actual stresses, and the stress scales used are, therefore, purely relative. Either stress scale may be multiplied by a constant without altering the real value of the plot.

For commercial gears of a type and material similar to rear-axle gears, it may be found necessary to design for continuous operation at maximum

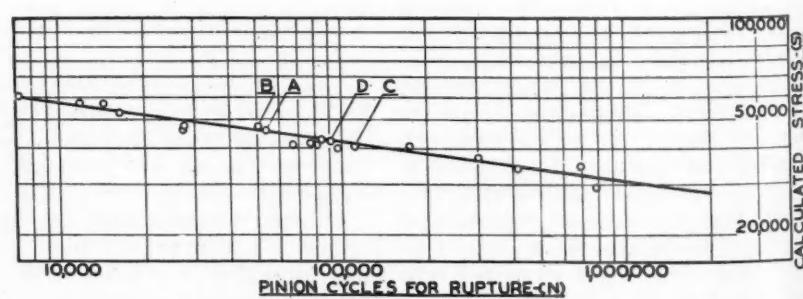


Fig. 3—Spiral bevel gear fatigue curve stress calculated by modified formula.

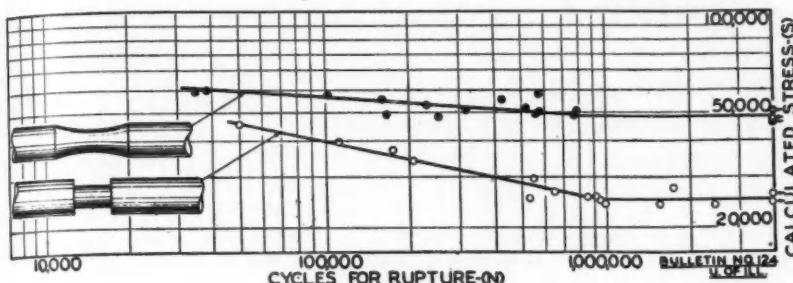


Fig. 4—Effect of shape of specimen on SN diagram from rotating beam tests.

stress. The permissible stress for such gears may be found by extending the fatigue curve shown in Fig. 3 to 10,000,000 cycles, which may be taken as the fatigue limit. This will show that gears designed for 20,000 lb. per sq. in. should be capable of operating continuously at this stress without tooth breakage.

Effect of Stress Concentration on Fatigue Life

Fig. 4 shows two fatigue curves taken from the University of Illinois Bulletin No. 124, by H. F. Moore and J. B. Kimmers. The rotating beam specimens from which these curves were made were identical as to material and heat treatment, but different in form. The specimen for the upper curve, having an endurance limit at 49,000 lb. per sq. in. stress, is of the form shown on the chart; the lower curve, showing an endurance limit of 24,000 lb. per sq. in., is for the shouldered specimen. This stress difference, however, is not real, but is simply the result of calculating the stress in the shouldered specimen without allowance for the stress concentration resulting from the sudden change in section. The fatigue tests, which respond accurately to the real stresses, provide means for correcting the stress formula for the shouldered specimen in terms of the uniform stress specimen, since the real stress is obviously the same for both forms.

The difference between the real stress and the calculated stress will not be the same for different forms of fatigue specimens; that is, the errors in stress calculation will vary, depending upon local conditions producing stress concentrations. The true stress in any form of laboratory specimen having stress concentration can only be found, so far as the author is aware, by a sufficient number of fatigue tests on the specimen to construct a fatigue curve from which the stress concentration factor may be determined by comparison with similar data on a simple specimen. This method of determining true stress is, unfortunately, not yet

applicable to machine elements, since it only admits of stress determination in terms of a uniformly-stressed, or other form of standardized specimen. General Motors Research Division has attempted to correlate tests of rotating beam-fatigue specimens and rear-axle gear tests, with the hope that the true stress could be determined and materials evaluated, but the results have been disappointing.

The Carburized Gear Tooth—Specifications for Case and Core

The shock theory of tooth failure in axle gears has led to erroneous conclusions with regard to relative strength requirements of case and core. In consequence, laboratory tests designed to aid in evaluating materials have led the investigator astray, since these tests were responsible for the widely-held belief that any carburized gear tooth should have a hard case and a tough core. The fatigue theory of failure alters the conception of case and core requirements.

For many years it was customary to test automobile gears in various impact machines. The designer of this type of test assumed that gear teeth in service were subjected to hammer-like blows, and he, therefore, attempted to duplicate in the laboratory this type

of load. Under this test the best material was that which resisted the greatest number of blows, notwithstanding the fact that the gear was usually ruined after the first impact. Hence, the specification that carburized gears must be of such materials and heat treatment as would produce a hard surface to resist wear, and a tough core to resist breakage by impact.

When it is realized that rear-axle gear teeth are not subject to hammer-like blows, the tough core requirement vanishes. As an intermittently loaded beam, the tooth surface must not only resist wear, but, since the bending stress varies from a maximum at the surface to zero near the tooth center, it becomes important to provide a surface highly resistant to fatigue in bending; less fatigue resistance is required of the core, depending upon the depth of carburization.

Fig. 5 shows a qualitative distribution of stress between the case and the core. The vertical ordinate represents the half thickness of a gear tooth, the horizontal scale represents stress. The actual surface stress is usually far greater than the calculated value, due to stress concentration caused by surface irregularities, as illustrated by the dotted line. As calculated, the maximum stress in the core is less than the stress in the case, by a relatively small amount if the case is thin. Unless the fatigue resistance of the core is proportionally as great as the fatigue resistance of the case, fracture will start in the core. Stress concentration factors, such as rough or scratched surfaces, change of section, etc., have the effect of increasing the stress difference between the case and core, thereby reducing the fatigue-strength requirement of the case below the value indicated by direct calculation.

Fig. 6 shows the results of three groups of rear-axle gears carburized to different depths. Point E is the aver-

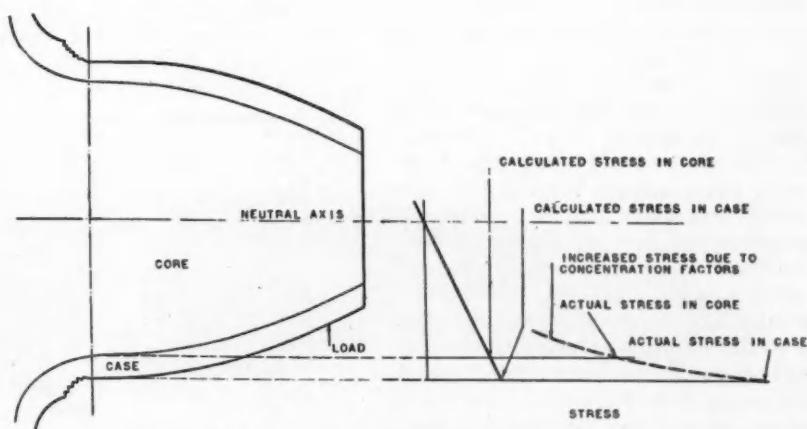
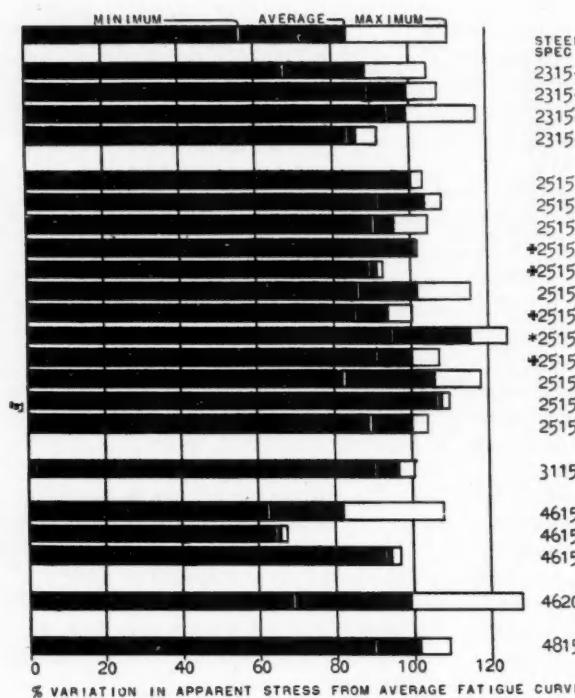


Fig. 5—Showing qualitative distribution of stress between the case and the core

Table I



STEEL SPEC.	CARB. TEMP. °F.	CASE DEPTH INS.	QUENCH	REHEAT TEMP. °F.	QUENCH	DRAW TEMP. °F.	MIN.	NO. OF AXLES TESTED
2315-A	1660	.050-.055	IN OIL	1325-35	IN OIL	300	30	18
2315-A	1600	.045	IN OIL	1325-35	IN OIL	275	30	89
2315-A	1675	.050-.055	IN OIL	-	-	300	30	14
2315-A	1660	.040-.050	IN OIL	-	-	-	-	7
2515-A	1650	-	COOL IN BOX	1475	IN OIL	-	-	3
2515-A	1700	.050-.055	COOL IN BOX	1400	IN OIL	300	-	9
2515-A	1675	.045	COOL IN BOX	1380 CYN.	IN OIL	250	30	11
*2515-A	1675	.045	IN OIL	-	-	250	30	3
*2515-A	1675	.045	COOL IN BOX	1380 CYN.	IN OIL	250	30	2
2515-A	1675	.045	IN OIL	-	-	250	-	10
*2515-A	1675	.045	IN OIL	-	-	250	30	3
*2515-A	1675	.045	IN OIL	1380	CYN. FLASH & QUENCH IN OIL	-	-	2
*2515-A	1675	.045	TRANS. CYN. & REDUCE TEMP. TO 1350	& OIL QUENCH	-	-	-	12
2515-A	1700	.050-.055	COOL IN BOX	1400	IN OIL	300	-	12
2515-A	1660	.040-.050	IN OIL	-	-	-	-	3
2515-A	1675	.045	COOL IN BOX	1380	IN OIL	300	COOL IN AIR	5
3115-A	1675	.050-.055	IN OIL	-	-	300	30	5
4615-A	1675	.050-.055	IN OIL	-	-	300	30	14
4615-A	1650-80	.050	IN OIL	1425	IN OIL	300	60	2
4615-A	1675	.040-.050	IN OIL	-	-	300	60	3
4620-A	1675	.040-.050	IN OIL	-	COOL IN AIR	300	60	14
4815-A	1680	.050-.055	IN OIL	1420-30	IN OIL	300	30	7

*COARSE GRAINED STEEL. *FINE GRAINED STEEL.

age of three gears carburized to approximately 0.037 in. depth, point F is the average of three gears carburized to the normal depth of approximately 0.045 in. depth and point G is the average of three gears carburized to a depth of approximately 0.082 in. These data are too meager to be conclusive, but they indicate that resistance to fatigue is improved with reasonable increase in depth of carburization. It should be noted that the normally carburized gears, point F, failed earlier than normal expectancy, and that the deeply carburized gears, point G, about matched normal expectancy.

The Effect of Material and Heat Treatment

Notwithstanding the many metallurgical reasons and tests that are advanced to show this or that alloy steel is best for rear axle-gear purposes, there is no evidence from the present study to show that, among the alloys usually used for this purpose, one is superior to another. Fig. 7 is the same average fatigue curve as Fig. 3, except that it records tests of 250 axles which were made from 22 combinations of alloys and heat treatments as noted in Table 1. It will be seen that, regardless of material, heat treatment or grain size, the test points for any given material lie about equally divided above and below the average curve. Large deviations from the average are due to other reasons than metallurgical ones, as will be shown.

It is not intended to deny that there are real differences in the various alloys or in the effects of the various heat treatments. These differences, however, have been determined from rather ideal laboratory tests, under which conditions such differences are large enough to become appreciable. In highly-finished, uniform-section structures, such as ball and roller bearings, wrist pins, ground shafts, and the like, the superior properties of expensive alloy steels are usually realized. In structures having high stress concentration, such as production rear-axle gears and many other machine elements, the properties of alloy steels, as determined by the usual laboratory tests, are not realized. The selection of steel for rear-axle gears should be governed by warping tendencies, machining characteristics and cost.

In Table 1 are listed the 22 combinations of alloys and heat treatments

represented by the test points shown in Fig. 8. The bar chart at the left of the table compares these combinations on a stress basis as indicated by the tests. Note that, on the basis of this comparison, coarse grained 2515-A steel makes the best showing and that 4615-A steel is the poorest. This comparison, however, is not a true measure of the material or heat treatment. The differences are due to other factors, as discussed below.

Fig. 8 gives fatigue data for a series of tests that was designed to evaluate materials and heat treatments other than those used in production at that time. The series consisted of three axles each of nine combinations of materials and heat treatments. The early failure of these gears demonstrates the difficulty of producing good gears in small quantities, due to the effects of unfamiliar warping characteristics of the steel. In preparing for tests of new

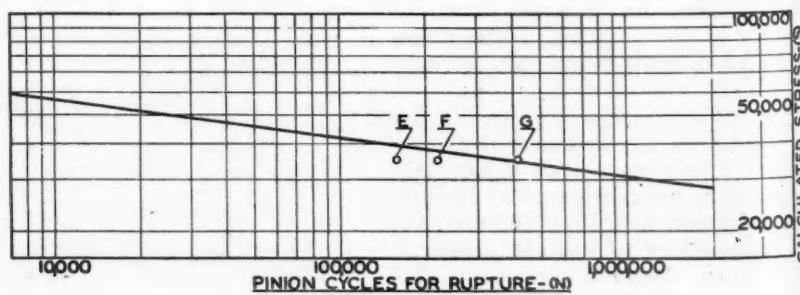


Fig. 6—Spiral bevel gear fatigue curve. Case depth E = 0.032 in., F = 0.045 in., G = 0.082 in.

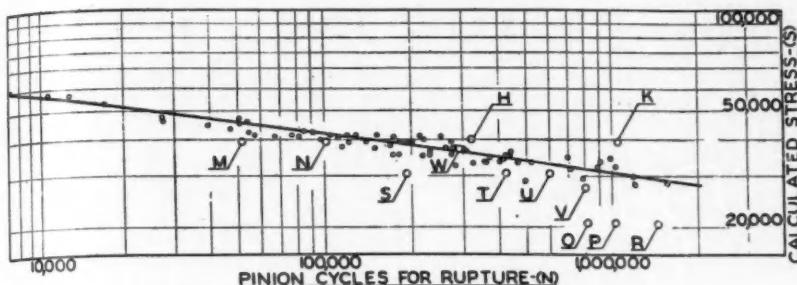


Fig. 7—Spiral bevel gear fatigue curve representing 250 rear axle gears.

production axle gears, it is customary to make a large number of gears and select from them the few that are good enough for use. The cutting is then adjusted to compensate for distortion.

The Effect of Stress Concentration Factors on Axle Life

Properties of the alloys are obscured by the much greater effects of stress concentrations, which, in gears, result from the tooth shape, machining scratches, deflection of the gears, shafts and bearings, eccentric assemblies, warping during heat treatment, etc. When considerable gain or loss is shown in the performance of a machine element, it is often ascribed to the particular alloy used, when, in fact, it is probable that the gain or loss resulted from a change of one or more of the stress-concentration factors.

Point H, Fig. 7, lies well above the average curve. This point is the average of three experimental rear axles which differed from production axles in that they were more rigidly supported, so that the stress concentration due to deflection was reduced.

The gears represented by points K, M and N, Fig. 7, were of identical design, material and heat treatment, notwithstanding which their lives varied as much as twenty to one. Point K is far above normal expectancy. The advantage in this case was reduced stress concentration, due, largely, to smoother finish of the roots of the teeth. Point M, lying below the average, was the result of bad machining scratches, together with bad tooth contact, which increased the stress concen-

tration. The gears representing the intermediate point N had good tooth contact as for K but severe machining scratches as for M.

The photographs, Fig. 9, show the fractured pinion teeth from the axles represented by points K and N, Fig. 7. The one at the left was cut with slow cutter feed, the other with fast cutter

missible radius, together with slower feed, greatly reduced the stress concentration due to cutter scratches. Note, however, that the fractures in these gear teeth follow the cutter scratches in both cases, demonstrating that further increased durability may be expected if practical means for producing smoother finish can be found.

The photographs show that these teeth were more highly stressed at one end than at the other, since the characteristic fatigue fracture does not extend the entire length of the tooth. Failure started at the root of the heel (large end) of the tooth and moved radially outward at that point as the fracture progressed toward the toe (small end) of the tooth. This is typical of all gear failures in our tests, and is mainly the result of elastic deformations, principally in the pinion anti-friction bearings, causing load concentration at the heel of the tooth, as discussed later.

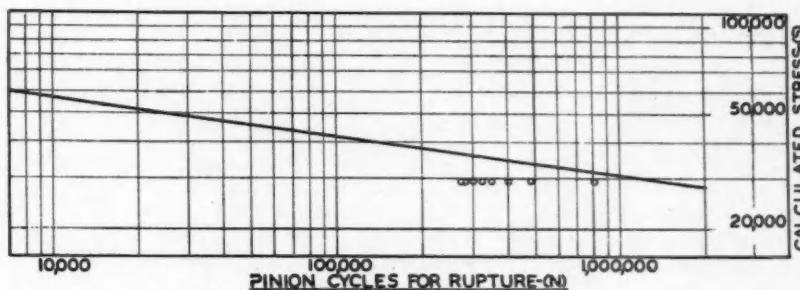


Fig. 8—Spiral bevel gear fatigue curve representing 27 special series rear axle gears.

feed. The difference in test durability was in the ratio of ten to one; that is, the coarse feed reduced the life of the gear from 1,000,000 cycles to 100,000 cycles. This test was not a deliberate test on the effect of cutter notches. The fine cutting feed was used while the gear cutting machine was being adjusted; the coarse feed was the normal cutting rate in production, aggravated by the fact that the cutting blades were not of uniform height. The use of cutter blades of equal height and with corners rounded to the maximum per-

Table II gives data on axles represented by points O, P, R, S, T, U and W, Fig. 7.

Points O, P and R represent axle gears that were unusually large for the car in which they were used, having, by extrapolation, a normal expectancy of 20,000,000 cycles, or two hundred times the minimum requirement. Because of their size, these gears were safe, notwithstanding extremely high stress concentration factors, and there was, therefore, no great incentive to improve their performance. The gears

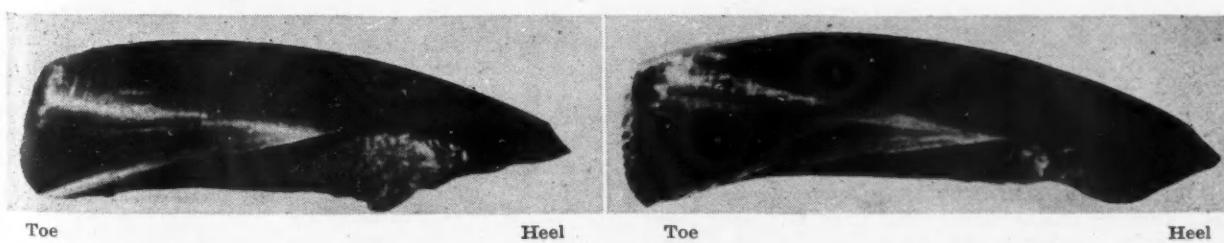


Fig. 9—Views of broken pinion teeth from the axles represented by points K and N in Fig. 7.

represented by points S, T, and U were for the same make of car but of somewhat smaller relative size. Although still over-size, an improvement was made in the rigidity of the pinion bearing, which is reflected in the position of the test points relative to the average curve. Subsequent increase of engine size required further improvement in design and shop practice, with the result that these smaller gears now have somewhat more than normal expectancy, as given by point W. The two gears represented by point O are responsible for the poor showing of 4615-A steel in Table I, which, as has been explained, was not the fault of

Plot Point	No. of Tests	Steel Spec.	Minimum Life	Maximum Life	Average Life	Average Life in % of Expected Life
O	2	4615-A	656,700	969,000	813,000	4.8
P	5	4615-A	556,000	2,072,000	1,178,000	7.
R	4	2315-A	1,120,000	1,700,000	1,422,000	8.4
S	2	2315-A	141,000	242,000	191,600	19.
T	3	4615-A	233,000	537,000	427,600	43.
U	3	2315-A	218,500	1,275,000	604,000	60.
W	3	4615-A	195,500	450,800	293,000	122.

either the material or heat treatment. Point V, Fig. 7, represents the average of seven axle gears of identical design, material and heat treatment, with gears that formerly had given normal expectancy. This test point was low be-

Table II

cause the manufacturing had been transferred to a new plant, and new personnel and the shop technique had not yet been mastered. Later gears of this design and material returned to the normal curve.

Part 2 will appear in the next issue of AUTOMOTIVE INDUSTRIES

Automotive Abstracts

(Continued from page 659)

reversing the bus if the normal turning-circle overhead equipment is not available.

Each bus is driven by an 80-hp. 500-volt motor placed within the chassis side frame on a flexible mounting. The buses are of the six-wheel type, the four rear wheels being driven, with a third differential between the two driving axles. The rear-axle ratio is 10.33 to 1. Shunt field resistances are mounted on the chassis side frame, while the starting resistances are located at the forward end of the chassis and are swept by the exhaust from the air-brakes, which has the result of reducing the temperature of these resistances by as much as 77 deg. F. under unfavorable conditions (heavy fog requiring frequent stops and starts).

An interesting feature of the control system is that normal overloads are dealt with by line contactors, which are fitted with automatic resets. This reset operates as soon as the master controller is returned to the "off" position. Serious overloads are taken care of by circuit breakers which, of course, are set to open at higher loads than the contactors. Both the power and the regenerative brakes are controlled by a single pedal through a master controller under the driver's seat. Forward movement of this pedal operates the various contactors which first cut out the starting resistance and then weaken the shunt field of the motor. As the pedal and master controller are returned to their "off" positions, the shunt field is first strengthened and regenerative braking is obtained, until a speed of about 12 m.p.h. is reached. The rheostatic brake circuit is then completed and operates down to a speed of 4 m.p.h., the changeover being made without opening the circuit or loss of braking effect. The retardation does not exceed 4 ft. per sec. regardless of the speed or the position of the controller.

—Engineering, Sept. 27.

Tests Diesel with Electrical Ignition

TESTS on an internal combustion engine with fuel injection and electric ignition were made in the mechanical laboratory of Aachen Technical College, Aachen, Germany. A precombustion-chamber Diesel engine was used for the purpose, the compression ratio being reduced from 17:1 to 6.05:1 by inserts between cylinder and head. Two spark plugs were provided, one in the precombustion chamber, the other in the cylinder. A bevel-gear differential was inserted in the drive of the injection pump, which made it possible to vary the time of injection began from 130 deg. before the end of the exhaust stroke to 15 deg. before the end of the compression stroke.

It was found that the thermal efficiency was a maximum at all engine speeds if injection began 60 to 50 deg. of crank angle before the end of the exhaust stroke. Horsepowers and b.m.e.ps. obtained with this engine when injecting gasoline were compared with the corresponding curves from the same engine when operating as a Diesel with 17:1 compression ratio. When injecting 0.244 lb. of gasoline per cu. ft. of displacement, the gasoline engine at 1500 r.p.m. showed a b.m.e.p. of 86 lb. per sq. in., while the Diesel engine at the same speed developed a b.m.e.p. of 75 lb. per sq. in. The fuel consumption, however, was less with the Diesel. The following conclusions were drawn from the results of the tests:

1. For maximum power and economy injection must begin very early, before the completion of the exhaust stroke. It seems that complete vaporization of the fuel before ignition calls for considerable time and heat.

2. No advantage is gained by increasing the injection pressure beyond 25 atmospheres, as the considerable heat in the combustion chamber at the moment of injection during the latter part of the exhaust stroke is sufficient to vaporize the fuel even if it is not very finely sprayed.

3. It was considered remarkable that in spite of the comparatively high compression ratio of 6.05:1 with gasoline there was no tendency to knock, and this probably also is accounted for by the good vaporization of the fuel.

4. Whether or not the precombustion chamber had any effect on the engine characteristics could not be determined, as all tests were made with the one chamber, the volume of which was rather small in comparison with the enlarged combustion chamber—A. T. Z.—Oct. 10.

SOME months ago we published in these columns an abstract of a long article on two-stroke engines by Dr. Herbert J. Venediger in *Automobiletechnische Zeitschrift*. A translation of the complete article has now been issued as a Technical Memorandum (T.M.776) by the National Advisory Committee for Aeronautics, Navy Bldg., Washington, D. C.

November 16, 1935

Automotive Industries

JUST AMONG OURSELVES

Some Haywire For A Bundle of Facts

SITTING safely on his high peak among the "prophets of the new prosperity," Major L. L. B. Angas, author of the "Coming Boom in Wall Street," beats the tom-tom for the motor-vehicle industry in a recent issue of the "Brookmire Commentator." With better times coming, Major Angas believes, the life expectancy chart for motor vehicles will become shorter, resulting in a "deferred replacement" demand for motor vehicles being superimposed on the normal demand to the extent that the resultant "potential" demand in 1936 will reach 9,800,000 cars.

Demand of this order will continue into 1938, according to Major Angas. The industry will over-expand, and there will probably be a slump following 1938.

This thesis is designed principally as a guide to the clients of a stock-market advisory service, and in its toying with millions, reminds us of Amos and Andy.

It is unfortunate, however, that at a time when the automobile-manufacturing industry is facing with confidence the prospect of 4,500,000 vehicles as its production budget for 1936, thousands of its stockholders should have held out to them the possibility of production figures of the magnitude envisioned by Major Angas.

From the theoretical standpoint his study is unimpeachable, but it fails to consider any but theoretical bases for prediction. Throughout its history on a

mass-production plane, the automobile industry has learned to distrust a purely statistical approach to its problems. There have been many times in the past where, if the trend curves of automobile production had represented facts rather than tendencies, the automotive goose would have been hanging very, very high.

The economic "laws" which govern automobile production are not found in a world of charts and graphs. They are founded on bitter knowledge of how regional sales, for instance, may be influenced sharply downward by acts of God and Government, how an automobile company may issue in a given year a good piece of engineering which lengthens the normal life expectancy of its products for a time, how the credit situation may change to expand or restrict the facility with which automobiles may be purchased.

There is plenty of need in our industry for a full-length portrait of the factors which influence the purchase and production of automobiles. Major Angas has made the error of offering the bare outline of such a study as the complete picture.

Petroleum Men Lay a Spectre

THE petroleum reserves of the nation are 100 per cent greater than they were 10 years ago, and, properly managed should be good for another 25 years. On this comforting note, the American Petroleum Institute opened its annual conven-

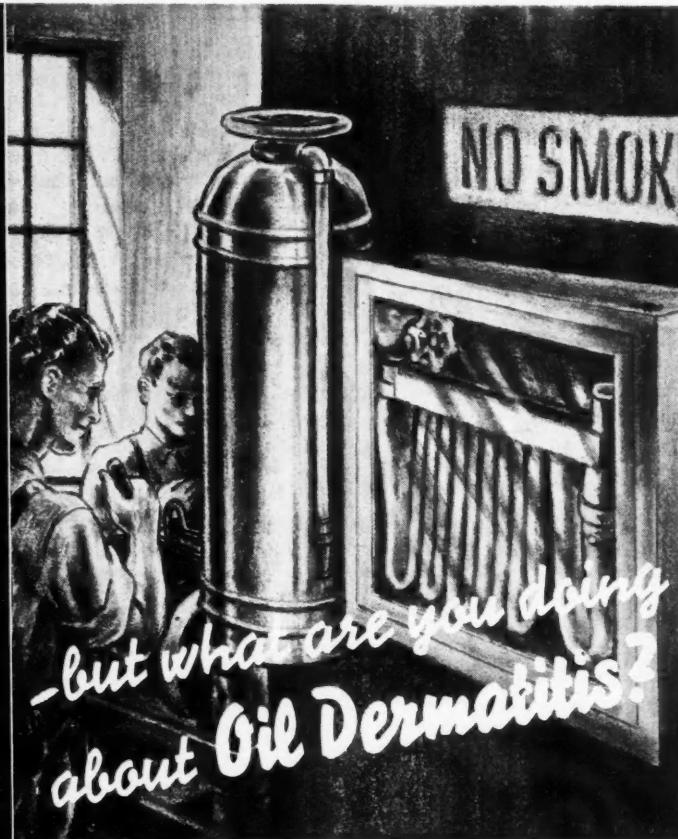
tion in Los Angeles this week. Even if the visible reserves of petroleum are exhausted at the end of 25 years, coal and oil shales will furnish a virtually unlimited supply of fuels and lubricants, according to a report submitted to the A. P. I. board of directors by its executive committee.

Among the contentions of those who favor blending alcohol with gasoline has been the possibility that our petroleum supply was rapidly nearing the exhaustion point, and that by beginning the use of alcohol blends we could fend off for a few more years the eventual shortage of motor fuels. The A. P. I. report indicates that "weaning" of our motor vehicles away from gasoline can be postponed indefinitely, which means considerable saving of money to the American motorist, and to the automobile industry, which would have to redesign engines for efficient operation on alcohol-gasoline blends of fuels.

In the Philippine Islands, which must develop a program of economic self sufficiency to take full advantage of the political liberty which has been granted them, experimenting with alcohol as a fuel has proceeded on practical lines under the direction of Dr. A. L. Teodoro, of the University of the Philippines. There are other places in the world where other-than-gasoline fuels are being sought for eagerly on a basis of national expediency. We have no quarrel with such motivations outside the United States.

But within our borders, the availability of petroleum as a fuel for the next 25 years is sufficient reason to table suggestions for the use of alcohol blends with gasoline on a broad commercial basis. It would be foolish to discontinue experimenting with possible substitutes for gasoline, but it would be more foolish to chase will-o-the-wisps of no or doubtful value when gasoline, constantly being improved in most of its properties, will be available for at least another quarter of a century.—H. H.

ANNUAL SYMPOSIUM ON AGRICULTURE AND ENVIRONMENT



■ **YOU** spend many a dollar protecting your plant from Fire. Without such safeguards, your business is in constant danger. But what protection do you have against Oil Dermatitis? A single germ, infecting cutting oil, can put your entire force under doctor's care . . . cripple production . . . cause compensation payments. Adding Derma-San to cutting oil prevents Oil Dermatitis. Like fire insurance, it offers protection you cannot afford to be without.

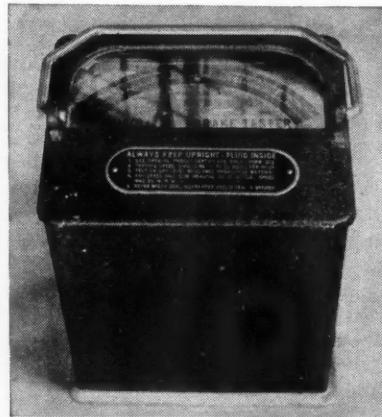
The HUNTINGTON  **LABORATORIES INC.**
HUNTINGTON, OHIO

DENVER HUNTINGTON, INDIANA TORONTO

DERMA-SAN IS EXCELLENT FOR ALL GENERAL PLANT SANITATION

Recording Decelerometer

A feature of the new Friedli-Feragen decelerometer is the recording device, whereby a permanent record is stamped in duplicate on a card. In operation the instrument is clamped to the left hand running board, the certificate is inserted in the slot, the car is started, brought up to speed and then stopped by a quick application of the foot brakes. The pointer and certificate in duplicate will record the stopping distance, exactly as if the car had been traveling twenty miles per hour, even though it may have been traveling above or below that speed at the moment the brakes were applied.

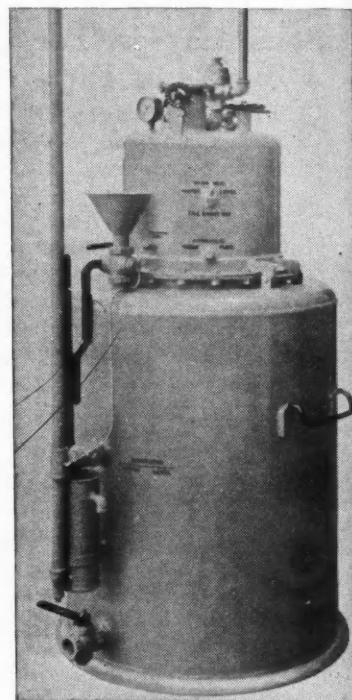


Friedli-Feragen decelerometer

This decelerometer is a product of the Bendix Products Corporation, South Bend, Ind.

Oxweld Acetylene Generator

A new small size medium-pressure acetylene generator for portable or stationary service has just been announced by the Linde Air Products Co., 30 East 42nd St., New York City. This machine has a 50 lb. carbide capacity with a rating of 100 cu. ft. of acetylene per hour. A handwheel at the top of the generator makes it possible to con-



Oxweld Generator

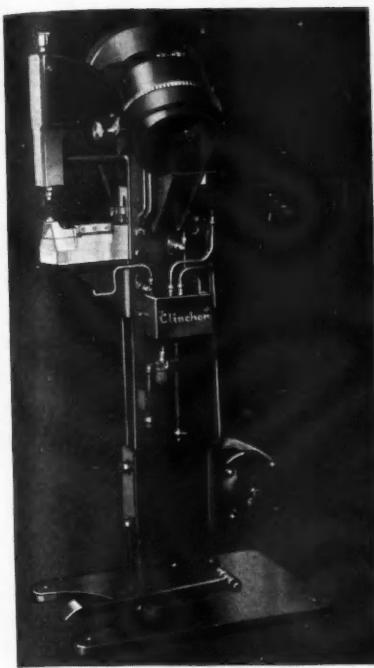
trol the carbide feed to produce any gas pressure desired up to 14 lb.

There is practically no exposed piping, and such operating mechanisms as the feed control, carbide hopper, hydraulic back pressure valve, and filter are all assembled within the dome-shaped top of the generator. The dome may be tilted back if access to the interior is necessary.

The machine illustrated is equipped with an overflow seal pot, vent tube, and vent pipes for stationary service.

Tomkins-Johnson Clinchor

The "Clinchor" is a new type machine designed to feed and set clinch nuts automatically. A combination of electric and air power is employed in the operation of this machine, an electric motor being used to drive the fly-wheel which supplies the power for



Tomkins-Johnson Clinchor

heading or clinching, and a small air cylinder, coordinated with the clinching mechanism, being used to select the nut and place it in a nest on the anvil. The flat side of the nut is said to always be in the correct position.

This machine, a recent development of the Tomkins-Johnson Co., Jackson, Mich., is controlled by a single foot pedal. The clutch is provided with a non-repeating feature said to insure quick action without the danger of repeating. This mechanism is built with a capacity of approximately 6 tons.

A new type of inclined drum hopper, operated through a ratchet drive, introduces a continuous agitation of the nuts and is said to provide a positive feed of nuts to the magazine.

New 200 Ampere Lincoln Welder

Powered by a 4-cylinder 23-hp. Waukesha engine, a new 200 ampere "Shield Arc" welder has just been announced by The Lincoln Electric Company of Cleveland, Ohio. This new model which supplies a uniform current for welding with bare or heavily coated shielded arc type electrodes, in all sizes up to $\frac{1}{4}$ inch, has a range from 60 to 250 amperes. The generator is the single operator, variable voltage type with completely laminated magnetic circuit and equipped with interpoles. Separate excitation of the generator shunt fields is supplied by an exciter connected on the generator end of the unit.

A field rheostat and a current regu-

WHAT'S NEW IN *Plastics?*

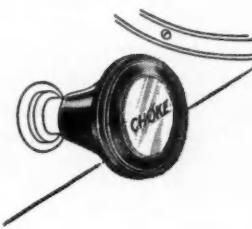
THIS MONTH: Gas Tank Caps, Ash Receptacles, Dash Control Knobs



Gas Caps: In smoothing off body projections, consider streamlined gas tank caps—molded of Durez. For instance, a Durez cap that hugs the fender closely and blends with the contours. Finger-groove and tail give leverage. Or perhaps an integral-molded teardrop on a flush Durez cap. Molded-in rivets clamp the lock securely. Lighter, sturdy, non-corrosive, unobtrusive.



Ashtray Frames: For arm-rest ash receptacles, try a rust-proof, stain-proof Durez frame, matching upholstery colors, with a metal can clamping onto molded-in lugs. Smooth, glossy surface contrasts well with dull fabrics. Can't rattle, dull, tarnish, chip, dent or discolor from burning cigarettes.



Dash Knobs: For inexpensive but extra-smart dash knobs, how about black or brown Durez bodies with colorful contrasting inserts of a more expensive material? The inserts can be wafer-thin to cut costs, and can be snapped into recesses in the knob face; identification on the insert or molded into the Durez, concentrically. By the way, larger dash knobs are definitely coming in.

Special Materials: For starter and generator motors, or any electric motor for that matter, try Durez 276 Insulating Varnish. It's very water and oil-resistant, gives better dielectric strength. Means more reliable armatures because Durez thermosetting resins are naturally tougher, more durable.

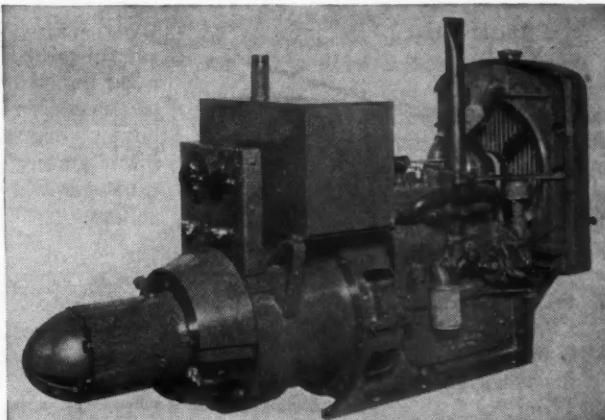
Durez is a hot molded plastic applied either in molding compound form or as resins for impregnating, coating, etc., or in sheet form. We are anxious to work with you in adapting this versatile material to your needs. General Plastics, Inc., 453 Walck Road, North Tonawanda, N. Y.

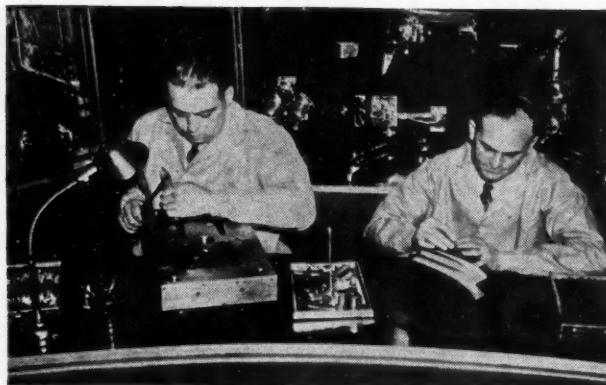
Choice of the Motor Industry

DUREZ • *Plastic Materials*

lating switch, together with electrode and ground cable connections of the wing nut type, are mounted on the steel control panel. The gasoline tank, which has capacity for a day's operation, is mounted over the generator. The weight of this new welding unit is 1078 pounds.

Lincoln engine driven welder





Master Craftsmen for Fisher Body. Walter L. Champoux, (left) who has been a steel engraver for 25 years, is shown cutting a door handle die. Working with him is Emil Fritz, artist, sculptor and engraver.

Three Men Who—

Three men—a professor of law, an engineer-journalist, and a former State Commissioner of Labor—take the center of the stage in labor relations in Detroit this week. The three men, J. Warren Madden, John M. Carmody and Edwin S. Smith, comprise the National Labor Relations Board investigating alleged infractions of the Wagner Labor Relations Act by Freuhauf Trailer Co.

* * *

The board seems to be approaching the complex problems of employer-employee relations with a fresh viewpoint armed with the powers conferred upon it by the Wagner-Connery Act. It is digging into the most minute details of employee relations with an informality that distinguishes it from the usual deliberations of a court.

* * *

The jurisdiction of the board is rather sharply defined. It may consider only those matters that relate to "free flow of commerce" and not to questions involving local industry. Observers are inclined to the view that ultimately it will be up to the courts to decide precisely which of the cases before the board actually may be considered within its jurisdiction.

New Lincoln

We had a look this week at the novel production lines laid out for the Lincoln-Zephyr. With the new body construction, the complexion of the assembly floor has been radically changed. No more frame line—no more chassis assembly line—no more body drop. Instead, they start with the body, to which the chassis units are attached directly.

* * *

A new paint shop involving an investment of \$250,000 makes the body shop one of the bright spots of the

industry. These bodies are finished in lacquer, in spray booths utilizing the hydro-filter principle, which not only protects the operators but provides a system for salvaging the lacquer fumes and residue.

* * *

Body and sheet metal parts travel on parallel overhead monorails through the paint shop and to the assembly floor. This simplifies the problems of scheduling color to a degree hitherto unapproached.

* * *

Engine assembly shows some interesting wrinkles. For example, at the start the block stands on end to facilitate the fitting of the camshaft, crankshaft, bearings, etc. Then it is rested bottom up for the pan, and finally, top up for installation of the head and accessories. Incidentally, single-point cylinder boring has been adopted on the V-12, using the same type of equipment that was developed for the Ford V-8. (This was described exclusively in *Automotive Industries* some short time ago.)

South Bend

Several days spent in South Bend impress one with a feeling of real prosperity for a community of its size. This is evident in the shops, their wares, and the morale of the inhabitants. All this reflects the good business brought into that part of the country by the bustling Studebaker organization, Bendix—the giant among parts makers, and Bantam—one of the liveliest things on rollers.

Approved List

The latest list of inspected and approved automotive appliances has been issued by the Underwriters' Laboratories of Chicago. This list,

PRODUCTION LINES

dated September, 1935, is a combined list of all types of appliances so that the whole ball of wax is found in a single package.

Steel Tops

Practically all jobs have solid steel roofs for 1936. An independent will feature what is undoubtedly the largest stamping made to date. Here is a one-piece panel stretching from the rear panel, including the rear window opening, across the full length of the roof, and then down to include the windshield opening and the top of the cowl. Imagine the size of the dies and particularly the size of the press required to handle this giant stamping.

Interchangeable

Design of the new Cord front drive body incorporates one of the best examples we have seen of interchangeable die construction. In appearance, the front and rear doors seem to be entirely different. Actually, both are made with the same die. What they do is to make a single die for the front, with a removable section which makes the wheel house clearance segment for the rear door. This is a masterly step in the economical production of small volume all-steel construction.

Still Growing

Maybe most of us do not realize it, but there are twenty-four different applications for stainless steel in an automobile, according to *The Enduro Era*. These include trim for cowling, tire covers, radiator caps, door handles, hub caps, lamp brackets, instrument panels, bumper and fender guards, etc. —J. G.

